Widening a Bottleneck: Towards a Better Patient Flow in Health Services

An analysis of utilization of specialized health services for diagnose-groups at the municipality level
Studied period from years 1999 to 2007

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ABSTRACT

BACKGROUND: The coordination reform is currently a hot political topic. Part of the reform's delivery arrangements is related to the expansion of municipal health services. This aims to relocate health services and increase the municipalities' share of responsibility. Financial measures are also proposed to support the other policy arrangements. Before these policies are introduce, it is important to see if an expansion and relocation of health services to the municipalities reduce the use of specialized health services. It is also interesting to find evidence on how the use of specialized health services with regards to specific diagnose-groups varies in the presence of municipal supply of health care.

OBJECTIVE: The main aim of this study is to predict if the coverage of municipal health care services might reduce or not the utilization of specialized health services at hospitals. That is, substitution or not substitution between the somatic level and municipal level of care. As a secondary objective, it intends to shed light on this with regards to different diagnose-groups to provide information on the potential effects of municipal copayment measures.

METHOD: Panel data from 1999 to 2007 aggregated at the municipal ward level is used for two types of analyses: total and limited diagnose-group populations. To measure the utilization of specialized health services, the study uses hospital inpatient admissions categorized in 5 diagnose-groups. Proxies of needs and variables that express the municipal supply are used in an weighted least-squares analysis to predict the variation of utilization of specialized health services.

RESULTS: Positive significant effects (1%, 5%) were present in the results concerning the coverage of municipal physicians. Negative but less significant effects (5%,10%), came from the other municipal supply side variables such as social and nursing care. The effects from the analyses vary across the different diagnose-groups.

CONCLUSIONS: The coverage of physicians increases the utilization of specialized health services in many of the results, and therefore there is not substitution from this type of heath provision. In contrast, the social and nursing care and other municipal supply side variables appear to reduce slightly the use of specialized health services.

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DEFINITIONS AND ABBREVIATIONS

HOD	Norwegian Ministry of Health and Care Services
RHA	Regional health authorities
HA	Health Authorities
Primary Health Care	Includes Nursing homes and home based services. These organs are governed by municipalities and are organized in the Norwegian Association of Local Authorities called **KS.**
GPs	General Practitioners
DRG	Diagnosis related group.
FFS	Fee for service
NOU	(Norges offentlige utredninger) Norwegian Official reports written by committees from the government or a ministry.
OECD	Organization for Economic Cooperation and Development
LEON	Lowest Effective Health Care level.
SSB	Statistics Central Bureau in Norway
St. Meld	Norway's Parliamentary report or commission
ABF	Activity Based Funding
SPSS	Statistical Package for social sciences
NOK	Norwegian Coronas
Specialized Health Services: SHS	Somatic hospitals, psychiatric health care and narcotic and high drunkenness intoxication treatment
NCSP	NOMESKO Classification of Surgical Procedures

1 INTRODUCTION

1.1General Introduction.

The coordination of health services is not a new issue in the Norwegian health system, nor in other Western health systems. As the proportion of the elderly and the incidence of chronic diseases are increasing steadily, the epidemiological development of many western countries, especially in European countries, present common challenges. In response, many OECD countries are working on a variety of health policies with the aim to improve health care coordination, and optimalizing the follow-up of chronically ill patients (Oxley et al,2009: 79-99). In the Norwegian health system, this issue started to be taken into account more seriously in the report NOU 2005: 3 " *Fra stykkevis til Helt – en sammenhengede helsetjeneste*". However, it was not until the St. Meld.nr.47- *The Coordination Reform*- that this issue took on importance in the Norwegian health politics arena when Bjarne Håkon Hanssen, the former Minister of Health and Care services, emphasized the insufficient coordination of health services as the main problem in the Norwegian Health System (Oxley et al, 2009:79-99).

This reform includes a vast variety of initiatives that ought to influence the Norwegian health services, and the inhabitant's health. This study will focus on the delivery arrangements of the reform, such as the new role for the municipalities, which is at the same time related to the financial arrangements. Both the shift of health services from somatic care towards primary health care and the aim to address the needs for health care in the municipality population through better coordination are intrinsic in those arrangements. Hence, the research problem is wether there is substitution of the provision from the somatic level of health care towards the primary level of health care. Therefore, this study uses a small area utilization (SAU) analysis to predict how the actual coverage of primary care services (municipality health care) influences the utilization of somatic health care services.

SAU studies have been used in medical investigation to provide information on the effectiveness of health care delivery, whilst economists have used it with focus on supply factors, and supplier induced *demand* (Bech, M & Lauridsen, J, 2008:50). This investigation is approached mainly from an economical angle, focusing on the variation in the proportion of inpatient hospital admissions using 5 diagnose groups aggregated across municipalities in Norway, which is the measure of the utilization of specialized health services in this study.

To predict the change in variation, this type of analysis includes proxies of need such as demographic and socio-economic factors, and proxies of supply of municipal health care aggregated at the municipality level.

This research project carries out two main analyses of diagnose-groups populations: one with the total population and another limited to an age group of 80 years of age and over.

Adittionally,This study is part of a collaborative work, including another study conducted by Einar Seim. His investigation includes the same research problem and type of analysis, but he analyses other diagnose-groups. Therefore, the results of this study should be considered together with Seim's results.

Looking at the effects of some of the municipal supply factors used in this study, the outcomes are not promising with regard to the possibilities of relocation and expansion of primary health care services, that is, substitution of the provision of specialized health services at hospitals. This is particularly the case in terms of the coverage of municipal physicians. However, in some cases, other municipal supply factors might reduce the utilization of somatic health services in some of the 5 diagnosed groups studied. Additionally, the effects found in the proxies of needs in the population vary throughout the 5 diagnose groups analyzed.

1.1 Section Structure

In the next subsections, I will sketch the historical background for this thesis and the institutional setting where the structural and financial aspects of the health system will be explained. *Section 2* Includes brief resume of earlier reforms and the coordination reform. Next, the theoretical issues will be discussed in the *third section*. This includes how the municipalities address the needs of their population by using economical principles, and a model describing the relationship between health needs, demand and utilization will be developed. This section concludes with exlaining how an economical approach can be used to study the possibilities of substitution between somatic and primary care (municipality health care services).

The *fourth section* is an in-depth explanation of the research problem, its study objectives, and its main research problem. Thereafter, the *sixth section* explains the methods and data collection: the sources of data, the research design and the empirical method.

The *fifth section* includes comments on the results, including tables to illustrate them. It consists of 11 main results. Five results are attributed to the SAU analysis of the total populations under study, while the other five include the limited SAU analyses. The last results come from an extended SAU analysis for one of the diagnose-groups. *Section 7* includes discussions about the results and the findings, while *section 8* presents the final conclusions from this study.

1.2 Background

The basis and reasons behind this study comes from the debate about how to implement the Coordination Reform. There has been internal disagreements in the red-green governing coalition between the Socialist Left Party (Sosialistisk Venstre Parti, SV), and the Labour Party (Arbeiderpartiet, AP), particularly concerning the role of the General Practitioners and the new responsibilities of the municipalities. For example, the Labour Party spokesperson of the case discussions, Are Helseth, expressed doubts about the efficiency of incrementing the number of man-years in municipal health care, assigning more working days to the municipalities (Hornburg, T., 2010). Thus, a question about the scope of demand of health services in the municipalities, together with the municipalities' ability to attend more patients emerges. This question is important and presents issues that need to be studied so as to provide more information that might help to ensure the success of the Coordination Reform. The analysis of the relationship between the supply of health services and its consumption for specific patient-diagnoses may consequently support the planning of relocation of health services, and the expansion of responsibilities in the municipalities. At the same time, it also can provide knowledge about what type of economic incentives best fits the new delivery arrangements.

An earlier study on the use of specialized health services concludes that the variation of municipality supply does not have effects on the use of specialized health services. Nonetheless, there are some effects on the supply of municipal health services. For instance, the hospitalization length is reduced if physicians' coverage is increased at nursing homes. It is also reduced when the institutional coverage in nursing and care increases for patients of eighty years of age and over (Hagen,2009:19-20). However, there is a limitation in this study in terms of variables that express the supply of municipality health care used to analyze the relationship between municipal capacity and consumption of specialized health services. Additionally, the span of this study is for one year, 2007, only. Therefore, it does not capture

the variation between municipalities and the tendency in utilization of specialized health services. For that reason, a further analysis can complement the inferences from this earlier study.

In order to understand the policy issues and the reasoning behind the Coordination Reform, it is necessary to first take a look at the institutional framework of the health care system, included in this section.

1.3 The institutional Framework

This chapter includes the definition, goal, and mandate of the Norwegian health system, how the system is financed, and its organizational structure. The description of the organizational structure does not describe all of its institutions, excluding e.g. private institutions and ambulatory health care. It rather focuses on the principal actors intrinsic into the health system and the actors that are important to the coordination reform.

1.3.1 The Goals and Mandate of the Health System

A health system includes all the activities that primarily aim to promote, create and maintain good health. This comprises all the actors, organizations, institutions, and resources with the potential to improve people's health. Additionally, the health sector should cooperate with other sectors which also influence people's health in society (Helsedirektoratet.2008a:16).

The Norwegian welfare regime is broadly characterized as being social democratic given its traditionally dominant role concerning the distribution of resources across the population, with the objective to assess the needs of the population based on a principle of equity (Jürgen, H & Heien, T, 1999: 342; Johnsen, J, 2006: 4). The government's mandate for the health sector is that everybody shall have access to good and equal health- and care services independent of their personal economy, sex, residence and ethnical background. The users of health services should be provided with good quality health services at the lowest possible cost (NOU.2008:2). Additionally, according to the National Strategy for Improvement of Quality in Social and Health services (2005-2015), the Norwegian authorities have pronounced the following main objectives for the health system: health services must be secure and safe, effective, coordinated, and should involve its users (helsedirektoratet,2008a:16-17).

1.3.2 The Organizational Structure and Provision of Services

The Norwegian Health System is structured on these three organizational levels, the national, regional, and local levels. The Ministry of Health and Care Services represents the national level and has the overall responsibility for the health care sector. Generally, the role of the government is to present national health policies, to plan and manage legislations, and to allocate funds ("Hit summary".2006). The ministry of Health and Care Services (HOD) is also in charge of the subordinated agencies such as the Health Directorate (HD), The Institute of Public Health, The Medicine Agency, the Patient Register, The Radiation Protection Authority, and the Biotechnology Advisory Board. January 1st 2009, a new external organization was created under the HD called the Norwegian Health Economics Administration (Helseøkonomiforvaltning, HELFO). It is composed by six regional units and has the responsibility among others to administrate the general practitioner scheme and to administrate and pay back demanded reimbursements (NAV: 2009). Consequently, the regional level is characterized by 4 Regional Health Authorities (RHA), and the local level is represented by the municipalities (431). The RHAs are responsible for the planning, provision, and financing of specialized health care. In contrast, the municipalities are responsible for the provision and financing of primary health care and social health services (Johnsen, J.2006.16-19).

The Regional Health Authorities and its Subordinated Health Authorities

According to the Hospital Act of 2002, regional authorities are divided into 5 main RHA: Northern Norway-, Central Norway-, Western Norway-, Eastern Norway-, and Southern Norway Regional Health Authority. This changed the 1st of June of 2007 as the HOD committee merged the Southern and Eastern Health Authorities (NOU.2008:20).The RHAs are responsible for approximately 32 Health Authorities at present. Both the RHA and HA are self-autonomous legal entities with their own executive boards. Furthermore, they have two main roles: the "care role" for the provision of specialized health services (SHS), and the supplier role as the producer of specialized health care. Among the SHS the RHA are responsible for are medical laboratory and radiologic health services, ambulatory services, and special care for persons with drug and alcohol addictions. Also, the HA have the responsibility for education of health professionals, research, and instruction to the patients and their relatives. (Johnsen, J.2006:20-21).

The Role of the Municipalities

§11 in the law for Municipal health and social health services states that: "The municipalities have the responsibility to offer health services to all of those that are residents at the municipality". In general, they are responsible for the provision and funding of primary care and social services (NOU2005: 3). Some of the areas under the purview of the municipal health and care services are the Regular General Practitioner Scheme, care of the elderly - including health visits and home nursing services, work with addiction and psychiatric health, municipal social services - including maternal, child health services and rehabilitation, dental care services, alternative treatment, public physiotherapy services and allocation of municipal services and the right to appeal (Helse og- omsorgdepartementet, 2009).

The General Practitioner Scheme: The General Practitioner Scheme was introduced 1.june 2001. This scheme gives citizens the right to choose a general practitioner (GP) as their family doctor (*fastlege).* The GP has the responsibility to prioritize the persons that are under his or her list. Therefore, the GP is the primary contact whenever the need for a doctor surges. The intentions behind this scheme is that the GP ought to coordinate the patient's need for other health services such as SHS. In this way, GPs operate as gatekeepers with regard to the provision of health services (Johnsen, J, 2006:19; NOU.2005: 29).

As this thesis asks what factors in the municipality ward influence the use of SHS, the interaction between GP's and the use of specialized health services plays an important role. Furthermore, the utilization of SHS involves an interaction of numerous decision-makers with different constraints. The figure 1 illustrates a typical patient flow. This patient flow may vary between municipalities given the variability on access to health services, and other factors such as the capacity of the GPs. (Iversen, T & Kopperud, G,2003:251; Hviding, Ket.al,2004:11).

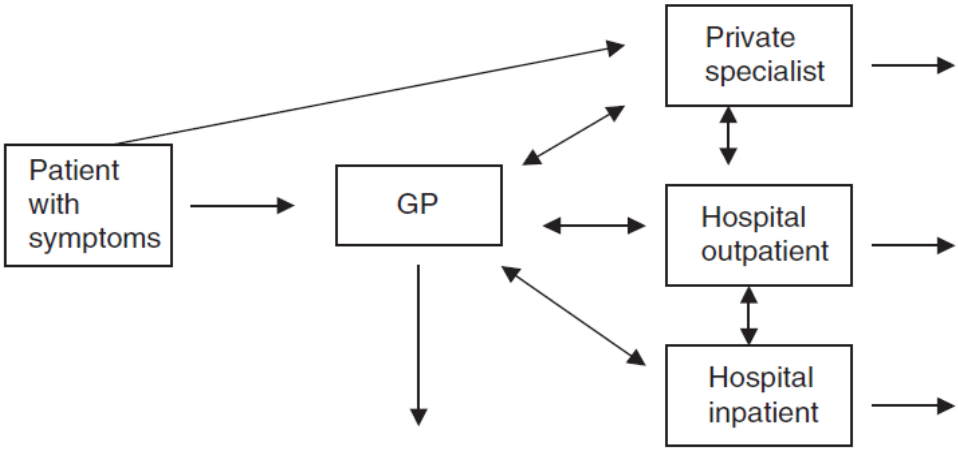


Figure-1 Patient treatment pathways, source: adopted from Iversen and Kopperud (2003)

For those patients that do not require emergency care, a user presenting symptoms of disease visits the GP. The GP has in this case three treatment pathways, treat the patient by her-/himself, refer the patient to a hospital outpatient section specialist or to a private specialist, or admit the patient to an inpatient hospital stay. Alternatively, the patient might contact a specialist directly. When the treatment is done, the patient may be sent back to the GP or to self-care. The arrows that do not have any connection represent the outcome when the patients are healthy again (Iversen, T & Kopperud, G, 2003:251).

Following this model, the actors interacting have different constraints. For instance, the preferences of the doctors and patients could be constraint by their time and income, taking into account that the GP is affected both by his/her own constraints, and the constraints of the patient. In contrast, the treatment at hospitals is assumed to be constrained by the hospital budget. The result of this interaction might end in utilizing health services either at the municipal level or at the hospital level. Thus, using variables that account for the factors that determine utilization of specialized health services at this level is important for this study (Iversen, T & Kopperud, G,2003.251).

Physiotherapy and Municipal Social Services: Rehabilitation: The municipal health care services also include medical rehabilitation. §5 in The Municipal Law gives the municipalities responsibility for assuring ”*brukermedvirkning på individ og systemnivå”* (service user inclusion on the individual and systemic level) for rehabilitation. This principle states that services should be given at an individual level, and they should facilitate the patients’ access to and interaction with the health service network. Physiotherapists and ergo therapists are particularly responsible for the provision of these health services as the

provision of these services usually takes place at the patient's home, a physical institutions, or nursing homes (*sykehjem*)(NOU.2005:3).

Care for the Elderly: The public social and care services are organized into the three main sectors of institutions, sheltered houses, and nursing homes. In this area of health care, the municipalities assume functions such as cancer treatment and pain therapy. The same principles for access and provision for rehabilitation also applies for elderly and disabled care (NOU.2005:31).

1.3.3 GP Hospitals and District Medical Centers (DMC)

Traditionally, the GP hospital units are collocated across nursing homes/social and care institutions, and medical centers. They represent an alternative for both hospitals inpatient admissions and treatment at nursing homes. The GP's has the medical responsibility and the nursing personnel works both at the GP hospitals and at nursing homes, but the professional and economic responsibility lies with the somatic level of health care according to hospital law (Aaras,1998:8-11). DMCs are a new concept of health care, and it is not clear yet which health services they should provide. They can be distinguished mainly as a collocation between primary care services and ambulant specialized health services, and also GP hospitals or intermediate sections. DMC's has three main elements of provision - outpatient clinics, filling the gap between primary health and somatic health services (GP hospitals), and providing primary health care services. Primarily, GP hospitals are localized in the north of Norway where the distance between patients' residences and general hospitals is large. In brief, they act as gatekeepers of general hospitals provision (Solhaug, F,2009).

1.3.4 The Financing System

The Norwegian national insurance scheme is mandatory and universal. It insures all Norwegian habitants based on both a tax system, and out of pocket payments to cover the provision of public health services. This insurance system covers stay and treatment, including drugs, in public hospitals. However, patients have to pay for travel costs and for the costs of certain drugs. The financing flow of the health system goes through different government bodies according to the structure of the health system and each of them are reimbursed by different payment incentives such as global budgets and prospective payments

(Johnsen, J, 2006: 47). figure 2 below depicts the intermediate financing flows as of the year 2006.

Tax revenues from the national government, the counties and the municipalities are transferred to finance all the different health services. Those services have to be afforded within an approved annual budget, as according to the law. The organ in charge of providing guidelines for the budget and to account for subordinated institutions such as RHA, is the Ministry of Health and Care Services. The intermunicipal variations in size and composition of the population are significant, and is reflected in the corresponding levels of expenditures and revenues. Therefore, the use of a mechanism to allocate funds is important to redistribute the revenues between the municipalities and counties. This mechanism is called the General Purpose Grant Scheme. This mechanism operates by compensating the expenditures of municipalities and counties depending on the characteristics of the population, the number of inhabitants, and the population's density (Johnsen, J, 2006: 47).

Yet, the allocation of funds for specialist health care has been a difficult task for the Norwegian government. The historical development shows that it has been a "blaming game" between actors as the expenditures of hospitals have been difficult to contain. This is mainly a consequence of a lack of optimal methods to calculate the expected demand for health services, and that the public providers/purchasers of health services do not really bear the financial risks when there are negative profits (Johnsen, J, 2006:48). Hence, one of the initiatives implemented to counteract the "blaming game" is splitting the providers and purchasers of health services. For instance, the RHAs act as purchasers of health services while the HA acts as the provider of SHS. At the municipal level, contracts between the GPs and the municipalities are usual. However, there are critiques of this model, particularly regarding contracts with private providers (Johnsen, J, 2006:50). In the next subsection, the payment mechanisms used for somatic health care and primary care will be explained.

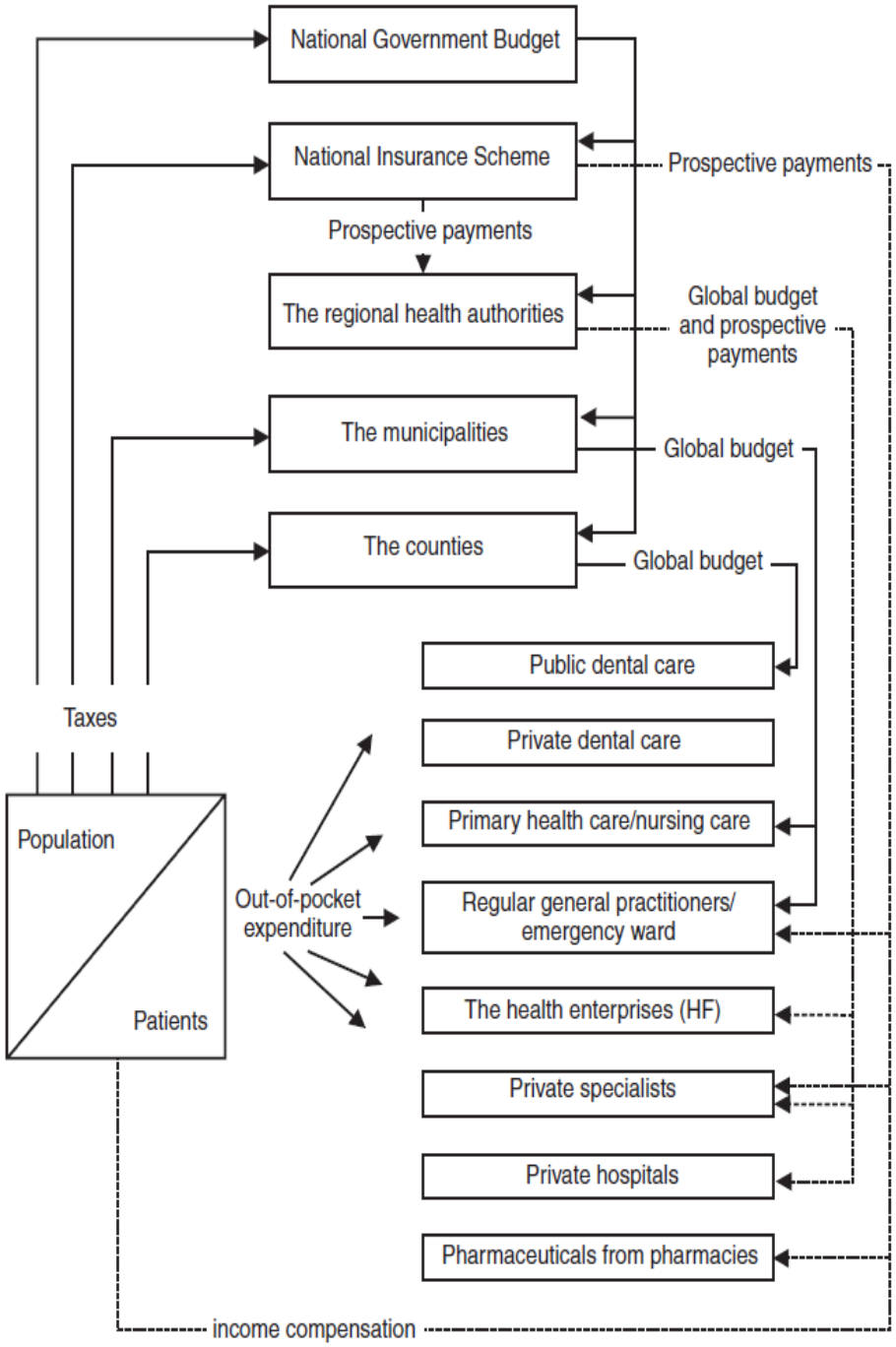


Figure-2 ***The financial flow chart, Source: Adapted from Johnsen, J(2006)***

Payment mechanisms

Somatic and specialized psychiatric Health care

After the 1st of July 1997 reform, funding for hospitals by merely a grant system changed with the introduction of an activity based funding (ABF) model. 30 % per cent of the block grant from the central government was substituted by matching grants based on the number of patients treated, patients within diagnose related-groups (DRG,) and a national standardized cost per treatment. The DRG system in Norway classify patients according to the international classification system (ICD-10, NCSP), and set up DRG-weights based on the national average costs. The percentage of ABF prospective model has varied in later years. Thus, after 2008 the fraction of ABF is of 40 % and 60 % of block grants. Additionally, the share of hospitals funding applies to the RHA, after the Hospital Act in 2002, instead of being funded to the counties (Johnsen, J,2006:52-53; NOU,2008:2:23).

Primary Health care

After the adoption of the Municipal Act in 1984, the municipalities have the responsibility of primary care. The financing for primary health care services have generally been block grants. To allocate funds, the state uses a distribution formula to determine the amount of block grants to the municipalities. As described above, the General Purpose Grant Scheme compensates cost differences and variations of need. (Johnsen, J, 2006: 51).

Also, other types of payments mechanisms are used to fund the municipalities. The National Insurance Scheme provides retrospective reimbursements such as fee-for-service (FFE) for health services provided, and patients pay out-of-pockets payments per consultation for a GP (92 NOK). Additional costs to the population are reimbursed by HELFO (Johnsen, J, 2006; NAV, 2009). In addition to FFE and out-of-pocket payments, fixed salaries apply to other local staff and for GPs located in areas with a low population density. In contrast, GPs who are independent contractors with the municipalities receive both a FFE component, which is based on the services the GP provide, and an amount of capitation reimbursement based on the number of patients on the GPs list (Johnsen, J, 2006:2006.51; Tjerbo, T, 2010:56; Van den Noord et al.1998:12).

2 BUILDING A BRIDGE BETWEEN HEALTH REFORMS

The current Norwegian health care sector is the result of various reforms. These reforms represent the government's attempt to meet the specific challenges of different time periods. A chronological representation will follow, with the purpose of clarifying the historical conditions for the current health sector. This thesis treats only the main reforms between 1970 and 2003. It is however important to highlight that the Nordic countries, including Norway, are based on the Beveridge-type health systems where universal coverage and equal access to health care at the highest standards is primordial. This model is the consequence of historical events after the World Second War (Krasnik, A & Paulsen, B, 2009: 235).

Table1.The Norwegian Health Reforms from 1970 to 2003 period. Source: Adapted from Hagen & Kaabøœ (2004)

Period and Reform	Reasons	Measures
1970. Hospital Act	"Blame game". There were conflicts between professions, administrators, politicians, local and central authorities.	*Organizationa*l: The counties received the responsibility for Institutional Health services. The tasks assigned to each of the 19 counties was among others, the planning and the operation of both the local hospital sector (somatic and psychiatric organizations) and specialized medical services *Financing:* - County councils were financed from local taxes and block grants from the national government. - To target specific activities, the central government provided earmarked grants. -Hospitals were financed by per diem reimbursement system (FFS). Nevertheless, these forms of payment has varied through this period.
1974-1975. St.Meld. nr 9 The Era of Per Diem System	Geographical differences in adequacy and equity in access to health care.	*Organizational:* The 19 counties were grouped into five Health Regions, and each region received one university Hospital. Regional cooperation was voluntary. *Financing:* The governments suggested a new reimbursement system based on block grants.
1980-1997.The era of Block Grant Financing. **1982. Municipalities Health Services Act**	- Cost containment of hospital costs - Need for better coordination.	*Financing:* Funding for hospitals and other activities was based on fixed annual block grants. This grants were developed into earmarked grants further to stimulate hospital activity Organizational: Strengthen services for institutional care and preventive care. The counties became responsible for primary care services.
1990- Legal waiting time guarantee	Long waiting lists	Counties received the responsibility for providing treatment within a time guarantee of six months. The results was not as it was expected
1997. St.Meld. nr 4. **The Era of Activity Based Financing**	-Increase hospital activity for elective treatments to fulfill the waiting guarantee list. - Block grants were inefficient and additional financing incentives were needed.	*Financing:* - Implementation of a matching grant to the counties. - Activity based funding was introduced based on the DRG-system for somatic inpatient activity. There was an increase of technical efficiency, but cost-efficiency was not achieved.
1999. Patient's Rights Act	Enhance the equality of access to good quality health care	Comprehensive arrangement of patient laws.
2002 Hospital Act	"Blame game" between the central government and the	The central government took the responsibility for all somatic and psychiatric hospitals, and other specialized health care activities.

	counties for the long waiting lists and the increasing deficits	60 % of the county council budget was transferred to the state. The Five health regions were organized as a health Trusts (RHA)
Period and Reform	**Reasons**	**Measures**
2002-2003. The Need for a New Reimbursement System	Need for new incentives to constraint hospital costs	40 % activity based system (ABF) and 60 % matching grant.

2.1 The rationale behind the Coordination Reform

Some of the challenges the Norwegian health system faces today, and that the Coordination Reform aims to address, were already reported in 2005 by the committee of the Health and Social Care Ministry (NOU 2005: 3). In their statutes, it is declared that many patient groups depend on how the municipal and specialized health care services are coordinated. A bad coordination can for example lead to unnecessary hospitalizations and failures of health services supply. Besides, representative groups of patients in the use of health care such as the elderly, the disabled, and those with chronic and mental diseases, are likely to benefit if measures for better coordination are implemented. Therefore, they clearly point out that there is a need for a continuous supply chain for health services on both municipal and specialized health care levels. Furthermore, based on the LEON principle (Lowest effective health care level), the committee wanted to allocate resources in an effective manner so that the patient is treated at the lowest administrative level and at the nearest geographical location (St.meld.nr.47,2008-2009:97).

Additionally, the committee believed that a "patient perspective" is central to facilitate the improvement of the health system. Therefore, as the "patient" or "patient groups" represent the users of health services, a good coordination between these and health providers is key to the development of effective health services at the individual and system level.

In the next subsection, the thesis will describe the challenges and the weaknesses in the current Norwegian health system.

2.1.1 Understanding weaknesses and challenges in the Norwegian Health system

In general, the Norwegian population when measured by life expectancy and other health metrics has good health. Comparing life expectancy gains at age 65 between the years 1970 and 2007, the growth in remaining years of life for women accrues to 20.8 years and 17.5

years for men (OECD, 2009: 18-19). Among the factors that may explain this gain are a greater access to health care, substantial medical and technological advances in health care, improvement of lifestyles, and higher prosperity. Hence, this tells something about the performance of the Norwegian health system. Inputs to the functioning of the health system such as service delivery might also at certain points have a positive impact on the Norwegian population's health (Helsedirektoratet, 2008a:7-8).

However, the Norwegian health system still suffers from weaknesses and faces both socio-economic and patient-related challenges. According to a government report (St.meld.nr.47,2008-2009), three challenges are of particular concern:

1. The patient's needs for coordinated services are not being sufficiently assembled

Tasks and responsibilities in service delivery are distributed according to two levels of administration:. the state/ Regional Health Authorities administrate specialized health services (SHS), and the municipalities administrate both primary care and nursing services. Consequently, this leads to a fragmented service provision where patients and their relatives often have to take the role of coordinators across different levels of care. Furthermore, patients and users are then exposed to unnecessary queues and health complications. Therefore, it is important to find a good solution for the very distribution of health services and responsibilities, both based on a patient's perspective since the coordination perspective is intrinsic to it (St.meld.nr.47,2008-2009:21)

2. The efforts related to the prevention of diseases and the lessening of disease burden, are relatively poor.

In short, the priority of the health system structure has all the way through been oriented towards the treatment of diseases and advanced medical complications, but not on prevention and early intervention when a disease is present. As a result, health treatments within specialized health care mainly occur when chronic diseases are in an advanced stage. Due to the expected growth in incidences of chronic diseases in the Norwegian population, and the increase of the proportion of elderly in the population, there is a need to focus on prevention and early intervention (St.meld.nr.47, 2008-2009:22).

3. The demographic development and the change of the pathological picture threat the society's ability to be economically sustainable.

The gain in life expectancy through the years shows that there is in effect an improvement in the health of the Norwegian population. Simultaneously, this brings new challenges to the health sector as the demographic trend of life expectancy has been a relatively straight line throughout the 20th century (Helsedirektoratet, 2008a:86-88). According to "Statistics Norway" (SSB) the share of the population of 80 years of age and over might increase from 190,000 persons in 2000 to over 500,000 persons in 2050 (St.meld.nr.47, 2008-2009:22-24). Hence, the ability to sustain economic welfare services is at risk as the proportion of the working population is decreasing relative to the elderly population. Furthermore, Norway has gone through an era of infectious diseases, into an era of chronic diseases, and this also has consequences on the public costs for the Norwegian society (St.meld.nr.47, 2008-2009:24). These challenges will implicitly form the basis of the discussions and analyses in this thesis. Following Next, the consequences created of these challenges will be discussed.

2.1.2 Part of the scope of coordination problems

Elderly patients:

Elderly patients often have a composite of diseases where the treatment necessitates cross-level care. The percentage of patients between the ages of 80 and 90 that are hospitalized, and also receive municipality services, is 50 %. Patients of 80 years of age and over also used 16, 4 % of the stays at hospitals in 2007, while they only represent 4,6 % of the overall population (St.meld.nr.47, 2008-2009:9). Hence, from these statistics patients of 80 years of age and over represent the highest consumption of specialized health care, when compared with other age categories.

Patients with one or more chronic diseases:

Patients with one or more chronic diseases constitute approximately 38 % of all hospitalizations. Among such diseases are heart diseases, diabetes, overweight, COPD, and psychiatric diseases. Such patients are in need of a long term follow-up at both primary care and specialized health care levels (St.meld.nr.47, 2008-2009:39).

Wrong inpatient and discharge outpatient admissions:

Taking current rates of patient dismissal and unnecessary hospitalizations as the point of departure, the inpatient admissions at hospitals for patients that are in principle treatable outside of hospitals, is likely to increase from today's 550 000 to 900 000 by 2030 (St.meld.nr.47, 2008-2009:40)

2.2 The coordination reform policies

The whole objective of the coordination reform is to address the present and future challenges in the health system, particularly as relative to changes in the Norwegian population. This reform is quite comprehensive and has different measures that should influence all the different areas of the health sector (St.meld.nr.47, 2008-2009:21). Nevertheless, only some initiatives will be described here for the specific purposes of this investigation

2.2.1 Clearer patient role

The goal of a clearer patient role is to enhance the patient flow across different health providers. This statement reflects the HOD committee's beliefs regarding the use of a *patient perspective*, as the aim is to meet the needs of the patients. With regards to the first challenge, the current government wants to introduce a law to ensure that patients with a particular need for coordinated health services is provided with a person that serves as a contact-point both under treatment and during the follow-up period. Another central point is to establish the necessary means for the prevention of diseases, and to involve the population in decisions concerning their own health, also so as to make them take on more responsibility for it .(St.meld.nr.47, 2008-2009:25).The following subsection will describe the new municipality role of the municipalities, as suggested in the coordination reform.

2.2.2 The new Municipality Role

Today, some tasks related to the provision of health services are inefficiently distributed between primary and specialized care levels. Many health services could with benefit be provided by municipalities instead of by the HA, and vice versa. The municipalities play an important role in the Coordination Reform. The government believe they are of core strategic importance to address the main challenges in the Norwegian health system. For that reason, the government wants to examine which functions and responsibilities should be assigned to

the municipalities, and which not. Additionally, the government wants the municipalities to take on more responsibilities. The responsibilities are related to prevention, early intervention, to set the necessary means for chronic patients, provision of treatments, and follow-up. All of this with the aim to provide a flow of patients with the most effective level of care. For instance, some studies show that patients ready to be discharged (*utskrivningsklare*) at hospitals would have a more cost effective provision at the municipality level. For this to happen, current and future tasks at the municipalities need to be studied comprehensively (St.meld.nr.47, 2008-2009:26). Thus, among the studies that are needed, are studies that investigate whether there is substitution between municipalities and HA. Such studies would be relevant prior to new health policies being implemented in the municipalities.

Parallel to this, a binding system of agreements between municipalities and health authorities and cooperation between municipalities are required. The cooperation and binding contracts will however not be compulsory. The agreements ought to include guidelines such as a description of the decentralization of outpatient clinics in specialist health care level, and a description of the use of GP´s.(St.meld.nr.47, 2008-2009:27-28).

Moreover, with the aim to meet the present and future demand of health, the government also wishes to increase the number of physicians in primary care. Some of the reasons for this measure are that patient groups such as elderly with lessened functional levels and persons with mental illness do not have an optimal access to GP's. Furthermore, with basis in a report from the HD (Helsedirektoratet IS-1652, 2008b) stating that there is a need to increase the capacity for GP's at the municipalities, the government wants to increase the number of man-years for general practitioners at the municipalities. However, this may have consequences for the utilization of specialized health services (St.meld.nr.47, 2008-2009:28). Financial incentives are supposed to support the earlier reform arrangements.

2.2.3 Financial Incentives

The overall goal of the use of financing incentives is to support all of the changes proposed in the coordination reform. Today, the financing mechanisms related to the health system do not give incentives for prevention efforts, neither to avoid unnecessary admissions at hospitals. For instance, activity based financing system (ABF) for specialized health services (SHS) produce incentives for effectiveness and production of health services, but not for producing

a comprehensive patient chain of services throughout the system as a whole. What is more, the municipalities (primary health care) do not have incentives to promote health, nor to receive discharge patients since these do not produce economic benefits. Therefore, the government aims to introduce three core-financing mechanisms. First, to implement a municipal copayment for SHS. Second, to transfer the economic responsibility for discharge patients in the hospitals to the municipalities. Third, to increase the degree of capitation grants for specialized health services from 60 to 70 % (St.meld.nr.47, 2008-2009:28-30).

The relationship between consumption of specialized health services and municipality provision:

The government believes that the provision of primary care can possibly influence the consumption of SHS. An example from the St. Olavs Hospitals and the Trondheim municipality shows that close coordination has reduced, among others, the hospitalization length and the amount of discharge patients at the hospital. However, empirical studies shows that municipal provision explains only until a certain point the patient's utilization of specialized health services. They show that both patients of 80 years of age and over and patients that are chronically ill, may potentially reduce the consumption of SHS at hospitals. Besides, studies show that higher physician coverage and better nursing and home care increases the use of SHS. Therefore, a new type of provision supported by financing incentives should create better health effects and also be more cost effective (see St.meld.nr.47, 2008-2009:29-30).

Models for municipal Copayment:

The government is considering three alternative copayment models. The first model is oriented towards a general financing model for all patient groups within SHS. In this model, a proportion (suggested to be 20 %) of the budget will go to the municipalities. The second model is limited towards specific patient groups, while the third is limited towards groups of patients of 80 years of age and over. The limited alternatives represent a lower risk for the municipalities. In addition, it is easier to follow the effect of municipal efforts compared with the general model. However, the limited model can reduce the municipal incentives to map the use of SHS for prevention and early intervention for groups in the model (St.meld.nr.47, 2008-2009:101).

The use of two analyses of utilization of SHS at the municipality level for specific groups of patients (diagnose-groups), and more specifically for the specific groups of patients that are in the age group of 80 years and over; can facilitate search for the effects in the flow of demand between the municipality level of care and for the somatic level of care services. Hence, implementing either this copayment system for specific patients groups or the copayment system for with the group 80 years of age and over, if the demand for specialized health care is not induced towards the municipalities, it can possibly provoke wasted human resources and unnecessary expenditures. As a result, an effective enhancement of the patient flow through the health care network might not be achieved (St.meld.nr.46, 2008-2009, 101-104).

Measures to avoid economic risks:

There are risks associated with the implementation of new financial means. In particular with the measure that aims to transfer the economic responsibility to the municipalities and the one related to municipal copayment financing. For instance, small municipalities are more exposed to unpredictable variation in patterns of consumption of SHS compared with bigger municipalities. The government is therefore concious about this risks and aims to implement financial incentives that avoid these type of risks. (St.meld.nr.47, 2008-2009, 101-102).

3 THEORETHICAL ISSUES

3.1 How municipalities adapt to the needs of their population

In section ,1.3.4, it was explained that the national government uses a distribution formula to allocate funds (block grants), to the municipalities. In addition, the municipalities tax their residents for the provision of services. This tax has a ceiling, which is set by the parliament. The formula compensates for variations in need for services and cost differences. As the municipalities have to handle the provision of different services, the allocation of resources should reflect the needs of the different groups at the municipal ward level (Johnsen, J, 2006:47).

These groups are, inter alia, the elderly and parents with children, which are then vital actors in the local decision processes. Therefore, it is assumed that local needs become proxies for the preferences of the different groups in the municipal populations (Hagen, 2009, handouts). The grants that the municipalities receive are fixed, and consequently the local decisions for the allocation of resources to these services are restricted by the total fixed grants (Børge, L, & Rattsø, J, 1995:708-709).

Using the assumptions of Craig and Inman (1986), the municipalities maximize the group specific utility, which is a function that is constraint by an exogenous budget - the fixed budget assigned to the municipalities. This model is illustrated in figure 3 below for a single municipality.

Figure 3 illustrates the budget constraint of the municipality. The budget is equivalent to the revenues of the municipality (taxes + grants). The Service X1 and X2 are two public services, i .e, care for the elderly (X1), kindergartens (X2) with different needs. Those types of services are used to represent a hypothetical scenario where a trade-off of different services is done at a margin. The maximized utility by the municipality (U1) depicted in the model is the indifference curve that is tangent to the municipality budget. The tangency point represents the rate when the marginal cost of the municipality equals the marginal benefits supplied to the municipality population (Børge, L, & Rattsø, J, 1995: 709-710; Folland, S et al.2004:32-34).

Hence, allocating the funds across several municipalities is then much more complex as the local needs of the different municipality populations need to be equalized in the distribution formula. In figure 4, budget constraint is depicted in which the desired allocation of resources shows a trade-off subjected to the needs of the different municipality populations (Hagen, T.2009.handouts).

This figure depicts an overall budget constraint which have to be equalized towards the needs of all the municipalities. The tangency points of the two indifference curves in the budget line represent the maximized utilities for two hypothetical municipalities. If the variation of needs of the population across municipalities cannot be satisfied at a given budget constraint, shifts in revenues are needed in order to compensate the municipalities. This effect is depicted in the model by an arrow (Hagen, T.2009, handouts).

Usually, analysis of use of health services for hospitals or municipalities are made with the purpose to allocate resources. However, the aim of this study is not to develop a formula to allocate resources, but to model the flow of demand to predict which factors affect the utilization of specialized health services (SHS) on specific diagnose-groups at the municipal level. Thus, the importance of the prior model lies in it depiction of how the flow of demand vary between municipalities depending on socioeconomic and demographic factors which are proxies of the needs of the municipality populations. Furthermore, it describes how the existing supply of health services is constrained by both other competing services, and the revenues located to the municipalities. As a result, the consumption of health services will be restricted by the level of supply for health services. In short, this model can serve as an inspiration for the following model of demand for health care, since it gives a hint about the basic principles of demand theory when provision of diverse services is given at the municipality level.

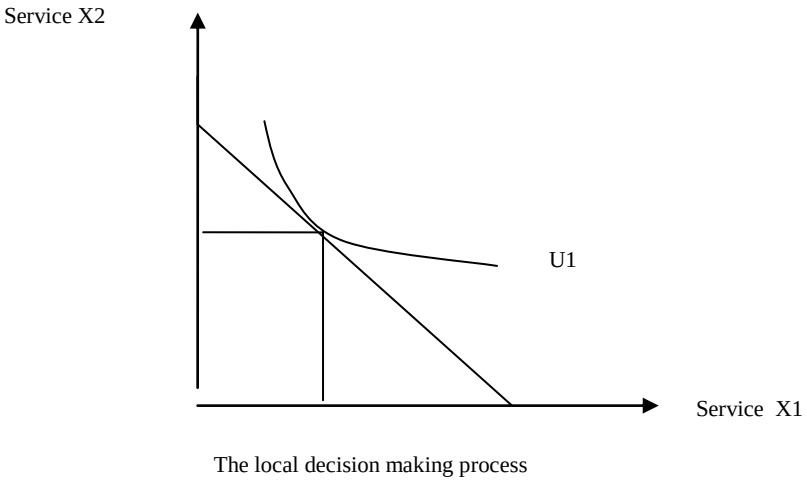


Figure- -3 ***The local decision making process, Source: Adapted from Lars-Erik Borge & Jørn Rattsø (1995)***

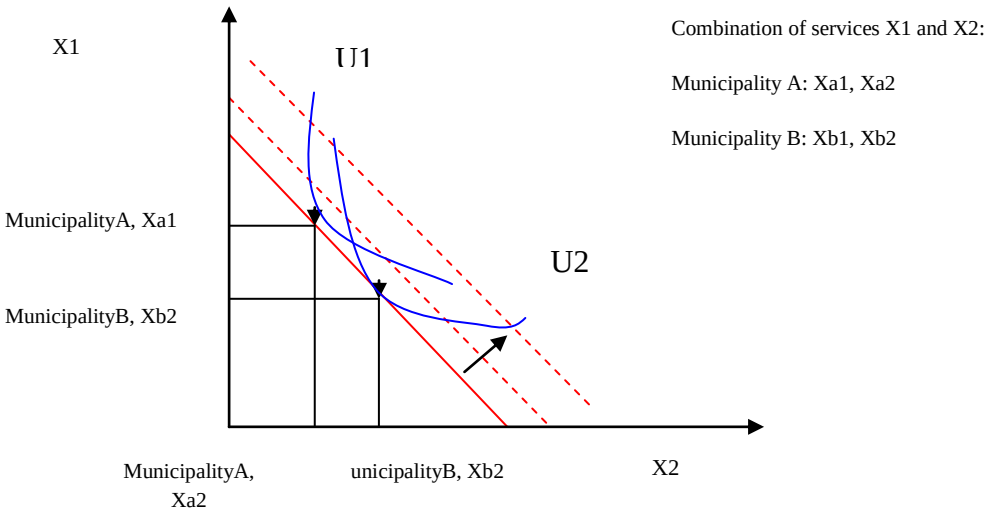


Figure-4 Multipurpose, Local Government, Source: Adapted from Hagen, T (2009) Handouts

3.2 An explanation of the relationship between need, demand and utilization

Regarding need-based theories, theorists discuss how health care is a special type of good which need a special principle of distribution (Williams, A & Cookson, R.2000:1887). In section 1.3.1, it was described how the overall mandate of the health sector is based on principles of equality of access to health services. More specifically, The Norwegian Ministry of Health and Care Services bases its activities on the principle of *"likhet i helse"*, equal health, and "*størst mulig gevinst*", the highest benefit possible (NOU.2008:2:40). Implicitly, this means that all needs for health care, reflected in the total demand for health services in the population, should be met, as everyone should have equal opportunity for accessing those services. Equality is achieved when relative differences in consumption mirror the same relative differences in need. However, measuring the need of health services is a complicated task as need for health care is unobservable. For instance, in a real world, it is plausible that some people are dissatisfied with provision of health care, because they do not receive the health care they need (Folland, S et al.2004:388). In part, this happens because of the inability to observe the individual needs for health care services directly, leading to an unmet demand (NOU.2008:2:40-41).

This section will introduce a model of the demand for health care with the aim to recreate the relationship of need, demand, and utilization as it embodies the main characteristics for a small area analysis of utilization. This model is depicted in the fig 5, and serves to systematically explain this phenomenon.

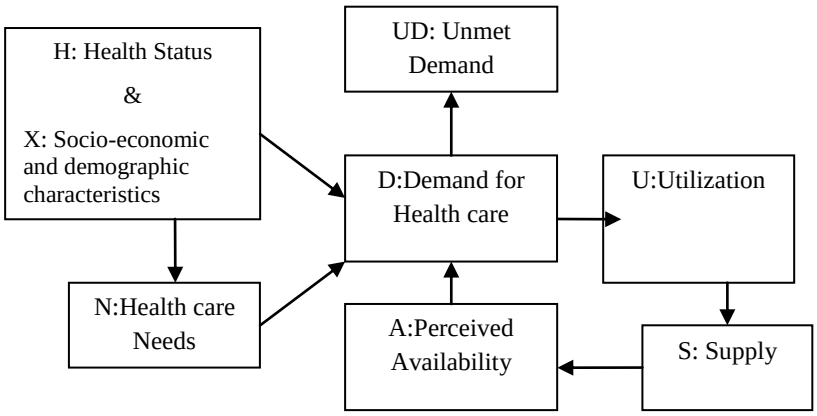


Figure-5 Model of demand for health care, source: adapted from Carr-Hill et.al. (1994)

In theory, the best measurement of the need for health care should be focussed at the individual level. However, as explained above, it is not possible to trace individuals' needs directly, also because data is not available today. Therefore, in this thesis, the needs will be considered at the municipality level, being the second best approach. An underlying assumption behind the individual's need is that need (N) depend both on the actual health status of the individual (sick or not sick) and on the available medical technology that gives the opportunity to benefit from health services (H). Simultaneously, the health status and the opportunity to benefit from health services vary with demographic and socio-economic factors (X). Hence, in a conservative manner all of this taken together produces a certain level of demand of health care (D) (NOU 2008:2: 41-43; Car-Hill, R et. al,1994: 27-31).

The perceived availability (A), in this case for municipality services, might also influence the demand for health care. For instance, the GP might decide weather or not to refer to a specialist depending on her constraints. The supply of health services (S) has a meaning as long as the demand of health is bigger than the supply. Therefore, the extent of utilization is determined by the level of supply. What is more, the supply is also going to have an effect on the utilization of health services subjected to the variation in demographic and socio-economic factors. For example, prevention and treatment might reduce the need for health services. In addition, the availability of comprehensive treatments for diverse diseases in developed health systems can also increase or reduce the needs for health care. For that reason, the need for health care is an object for subjective judgments. Hence, in this model the demand is an intermediate variable between need and utilization (NOU 2008:2:41-43 ; Car-Hill, R et al,1994:27-31). This relationship can be defined as:

Need = Demand, if the supply has no restrictions and there is perfect information

Demand = Utilization, if the demand > the supply

In sum, the need can be observed through the utilization of health services if the prior assumptions are met. This model can be illustrated algebraically by the following function:

$$Ui = f_1 (Ni, Si, Xi, Ai)$$

The degree of Utilization (Ui) in the municipalities is a function of health needs (Ni), the actual supply of health services (Si), the socio-economic and demographic factors (Xi), and the perceived availability of health services (Ai) (Car-Hill, R et al,1994:27-31).

This function is reduced as the perceived availability is a function of the actual availability of health services (Si), and the variation of socio-economic and demographic factors (Xi) (Car-Hill, R et al,1994:27-31). As health care needs is a function of socio-economic and demographic factors, leading to the following function:

$$Ai = f_2(Si,Xi),\ Ni = f_3(Xi) \rightarrow \mathbf{Ui = f4(Ni, Si,)} \quad (3.2.1)$$

In sum, the model can be simplified to look like this:

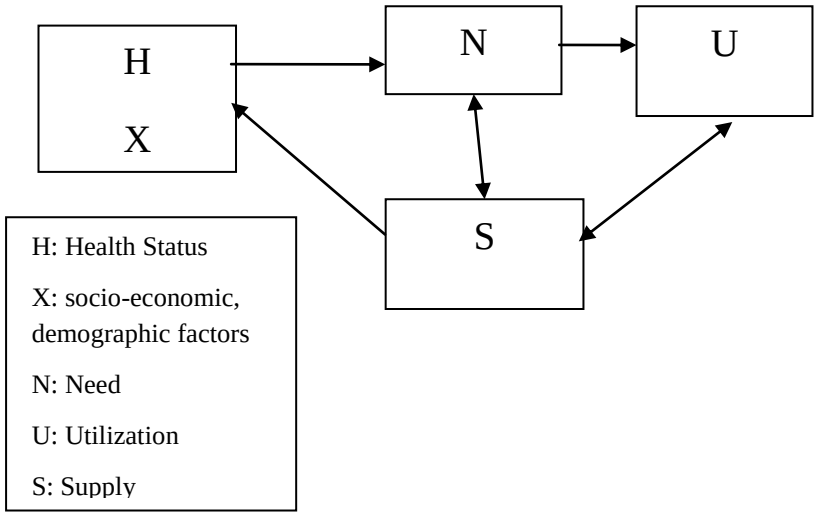


Figure -6 the simplified model of demand of health care, source: available from (NOU 2008:2)

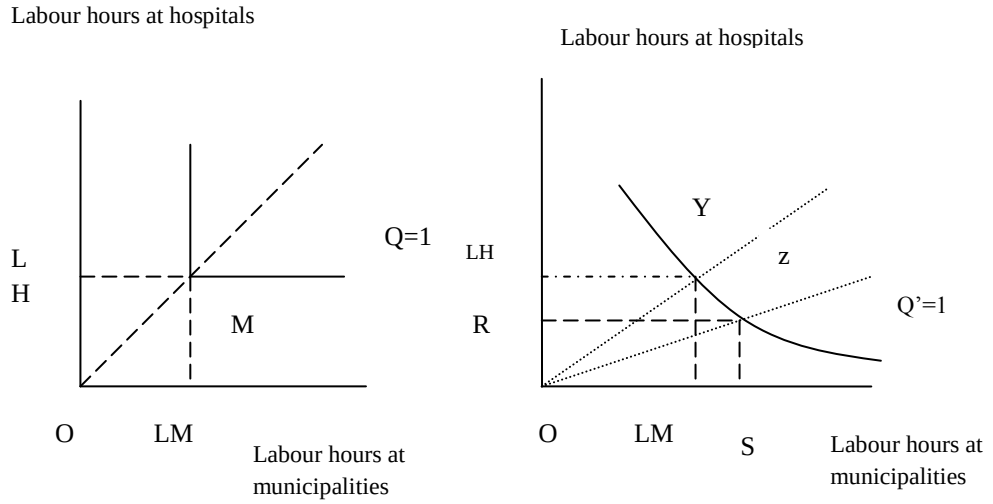
However, there are times when the demand of health care is not met appropriately (UD) as shown in the fig 5. For instance, some individuals might consume health services when there is not a need, and other might over consume or under consume health services independently of their needs. Geographical location and other factors can also be a barrier for access to health care. These events generate a gap between the need for health care and the utilization of resources given the hidden needs in the population. Accordingly, this study is going to use variables that can be proxies of need such as demographic and socio-economic variables, and supply variables that can in a conservative manner reflect the need for health care at the municipality ward level. In section 5, "methods and data", an empirical method for the analysis of utilization of SHS at the municipalities will be explained. The empirical method

aims to mirror the relationship between the concepts discussed in this subsection. One of the advantages of using the empirical method is that it is not subjected to the constraints of concerns with equity, or problems with ideal typifications, as explained at the start of this section (NOU 2008:2:42-43).

3.3 Possibilities of substitution between ha/rha and municipalities

3.3.1 Principles of substitution

The concept of substitution is introduced to show two scenarios where substitution is possible and where it is not. This economic principle is the base of the problem of this investigation, embedded in the research question of this thesis, expanded on below in section 4. By substitution is meant a flexibility to substitute one input, such as labor at the municipalities, by another input, the labor at hospitals, maintaining the level of quality of provision of health services (Folland, S et.al.2004:97). This effect is shown in fig 7.



A. No substitution B. Considerable Substitution

Figure-7 Degree of substitution between labor in hospitals and municipalities, source: Folland, S et.al.(2004)

A shows a combination of input at hospitals and at the municipalities. The isoquant, Q=1, illustrates the combination of both inputs to provide a treatment (0LH/0LM). Both need to be combined to produce a treatment. Adding more hours of municipality care is not going to provide a better treatment. This is a production problem since the tasks of labor at hospitals can only be performed there. Moving upwards from M, that is additional labor hours at

hospitals, or moving downwards from M, means additional labor hours at the municipalities is going to produce a waste of resources (Folland, S et.al.2004:97).

B shows a smooth-downward convex curve which means that different combinations of (LH, LM) can be used to provide a treatment. They are then equivalent to (0R,0S).The slope of the isoquant label by Q'= 1 is called the marginal rate of technical substitution. This means that the rate (0LH/0LM) can be switched in this case by (0R/0S) maintaining the same quality of treatment. However, the degree of substitution is limited since in the isoquant Z much more hours of labor at municipalities is needed, and vice versa, when the probability of availability of labor at hospitals is scarce (Folland, S et.al.2004:98). In the next subsection, it is explained how substitution or shifts of tasks between actors has happened through the latest years as a result of different inputs such as policies, professional interaction, and technological development.

3.3.2 Shifting tasks between actors in and out of the health system

Today, the results of patient treatments depend on the interaction of four main actors: the individual/patient, the family, social networks, and the municipalities and specialized health services (HA/hospitals). The interaction of this network gives the opportunity for a relative undefined distribution or shift of responsibilities in the health sector (NOU 2005:3).

The distribution of health services in the Norwegian health system is defined by law. Nevertheless, the responsibility for health care services between the municipalities and the HA shows an undefined line in terms of where the treatment of patients takes place in practice. This depends on the level of competence of the health professionals, the availability of medical technology, the economic resources and the traditions of the institutions in charge of the provision of health services. Thus, there has been a debate about the gray zone for the distribution of health services between these two main levels of health care. This shows that the interaction in the health system needs to be considered by a flow chain of services instead of seeing primary care and specialized health care independently. For instance, there is a connection within the admissions of psychiatric provision at HA and the capacity of the municipalities, or across the whole network. Lately, there has been an expansion of the municipality provision for primary care and specialized health care. This provokes a shift between the responsibilities in provision among actors. Arrow 1 in figure 8 below depicts

these shifts, where the municipalities have compensated the lower efforts from the other actors in the network (NOU 2005:3).

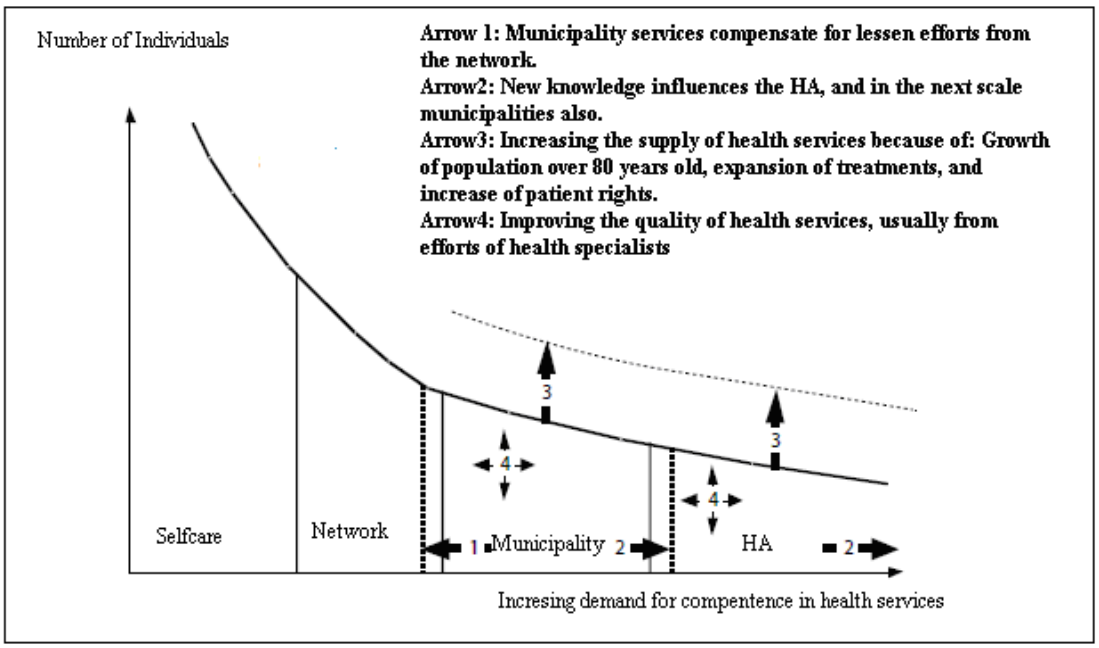


Figure-8. Distribution of tasks between health care actors, Source: Adapted from NOU 2005:3

Looking backwards from arrow 2 in figure 8, illustrates that more patients are receiving treatment and follow up at the municipality level than before. GP's have today more patient tasks which before were given at the specialized level of health care. Social and care services at the municipalities has more tasks than before. For instance, patients receiving advanced pain treatment, patients that use respirators, and those with mental dysfunctions, are receiving care at the municipalities. Moreover, the border line for which health services are provided in the municipalities or in the specialized level of care respectively, depends on economic mechanisms, and the structure of the health system, specially the HA organizational structure (NOU 2005:3:49).

Again, arrow 2 (figure 8) to the right shows how new knowledge influence the hospitals (HA), and the arrow 2 to the left, how it influences the municipalities. That is to say, the development of specialized health services has simplified the actual arrangements for these actors (NOU 2005:3).

However, this development and the constant increase in the population, especially the elderly, has also brought an increasing demand for health care (arrow 3 in figure 8). Hence, the

proportion of the group of 80 years of age and over who demand health care represents the greatest growth of hospitalization and use of municipal geriatric care. There is also a strong increase of supply for patients that are under 67 years old, for example provision for psychiatric patients. In addition, the implementation of patient rights has driven the demand for health care (NOU 2005:3).

Further, the expansion of the provision of primary care services is in part due to the efforts of the health specialists. This shows how the municipalities and the specialists have lived up to the objectives regarding the improvement of health services. This trend has nonetheless generated an undesirable effect, considering that the prioritizations and resource allocations should go through the political arena (arrow 4 in figure 8) (NOU 2005:3).

Figure 8, illustrates that there has been a shift or substitution of tasks/treatments in the health sector during the last years. Still, there are concerns about the low participation of GPs in treatment of patients that involve heavy social and care tasks in many municipalities. Finally, the proposal of a new municipality role emphasizes how new tasks can be transferred to the municipalities (NOU 2005:3). This clearly shows that substitution of provision of health services between somatic health care and primary care actually occurs. However, the waste of resources is not reported as the provision of some health services might be provided at both levels of care, and unnecessary costs are ensuing. And, most importantly, can an expansion of, for instance, the coverage of GP's replace the provision of some treatments by the hospitals?

4 RESEARCH PROBLEM

The reasons for and the potential benefits of this analysis were described in section 1.2. above In this section, the objectives and the research question will be stated with the aim to provide a broader understanding of the research topic. The main aim of this research project is to gain information on how the provision of municipal health services (primary care) influences the use of specialized health services at hospitals (somatic care) considering part of the delivery arrangements and financial arrangements included in the coordination reform. The Norwegian Health Authorities wants to relocate and to expand the provision of health services in the municipalities. Studying the variation in utilization of specialized health services (SHS) on specific diagnose groups can reveal which of those patient populations can receive a more comprehensive and effective treatment at the primary care level than they would have if referred directly to the somatic level of health care.

4.1 Research Question:

Is it possible that the provision of municipality health care reduce the use of specialized health services in hospitals? This research question intend to predict which of the two scenarios of substitution discussed in the section 3.3 could result, by running small area utilization analyses of specialized health services. In this study, the different diagnose-groups chosen might represent those patients that can receive treatment at the municipal health care level (primary care). For instance, patients with chronic diseases such as diabetes are a representative group. They are repeatedly mentioned in St.meld.nr.47 (2009) as one of the diagnose-groups where an expansion of primary care might have an impact on the health of those groups and simultaneously reduce the extent of inpatient admissions at hospitals. Hence, when the no substitution phenomenon shows up in the case of diabetes patients, inputs necessary to provide treatments such as GPs in primary care might not maintain the same level of treatment provided in hospitals. The contrary phenomenon appears in the case of substitution.

Not many studies on municipality utilization of health services searching for the present problem are previously done in Norway. However, in an analysis done by Hagen (2009:18-19) some effects were found by studying the total utilization of specialist health services (SHS). Variables of needs had significant effects on the total use of SHS, while no significant effects were found regarding variables that explain the provision of municipality health

services. In addition, a greater provision of nursing home physicians was found to increase the utilization of health services at hospitals.

These results are not supportive for some of the proposals of the coordination reform. For instance, the expansion of the coverage of physicians (GP's) in the municipalities and for other health personal in primary health care, might not substitute the demand of health services at hospitals. Nevertheless, there were some effects for groups of patients of 80 years of age and over. For instance, the utilization of services at medical divisions in hospitals was reduced for acute admissions when the coverage of social and care institutions was extended (Hagen, T 2009:19).

From those results, it is already known that there are relatively small possibilities for substitution. However, using panel data from 1999 and 2007, and studying the total diagnose-groups populations across the municipalities in Norway, the results should provide stronger evidence of substitution or not substitution between the two main levels of care in the Norwegian health sector. Additionally, a limited analysis focusing on diagnose-groups with 80 years of age and over complements this study, as they represent a high utilization of SHS and are part of the scope of coordination problems.

The intention is to drive a small area utilization analyses on specialized health services for 5 diagnose-groups. As introduced in section 2.2.3, there are two alternative copayment arrangements that can be implemented to reduce the potential risk to the municipalities. Hagen (2009:26) discusses how the municipality copayment might increase the risk to the municipalities, especially in small municipalities, if they do not manage to provide alternative health services to hospitalization. Therefore, these analyses shall estimate the underlying effects provided from the municipal supply of health services and proxies of needs in the utilization of specialized health services based on the patient populations that the two alternatives copayments want to address. As described in the introduction, the analyses are carried out for the entire diagnose-groups populations, and additional analyses are performed with the same diagnose-groups, but limited to a population that is of 80 years of age and over.

5 METHODS AND DATA

This section includes among others the type of study design used, the research design, data collection and the criteria for both the measurements of the explanatory variables and the studied variable. Secondly, the method describes the type of statistical analyses chosen, including the assessment of the assumptions and the empirical model developed for this analysis. The table of descriptives is depicted at the end of this section.

5.1 Study design and research design

The selection of the study design will depend on either the number of contacts with the study population, the reference period for the study, or the nature of the investigation. As the nature of the availability of the data involves only one contact with the study population in a period of 9 years, the study design that is best fit is a repeated cross sectional study. Longitudinal studies and before-and-after studies are not relevant here since they entail more that one contact with the study population (Kumar, R, 2005).

The research design for this study is based on municipal aggregated data, as data at the individual level is not available. Data about the different diagnose-patient groups used to study the differences in utilization of specialized health services is nested between geographical areas. The diagnose-groups are nested at the municipality ward level and at the same time, the municipalities are nested for the HA ward level. This leads to a hierarchical model with two wards, which offers the possibility to analyze contextual variables like income, education and mortality as explanatory factors (Snijders, T & Bosker, R.1999). In order to approach the research problem of this study, a weighted least-squares regression was used to analyze both the total populations of diagnose-groups and one limited to a 80 years of age and over diagnose-group population.

5.2 Data collection and measurements

As elaborated in the theory section above, the needs for health care and health care supply are the main elements in the health care utilization function. Yet, determinants of need for health care are not developed. Even more, as explained above, need by itself is unobservable. This analysis uses socio-economic and demographic factors to reflect this unobservable need for health care indirectly. According to the objective of this study, both demographic and health

care supply variables will be collected from the population at the municipality level (level M). In continuation, direct measures of health care resource provision are used. However, tracing the supply of health care resources is indeed constrained by the availability of data (Nerland, S & Hagen, T.,2008:45; Carr-Hill, R. et al,1994:38, 47, 55).

The panel data used for this analysis comes from a combination of three secondary sources over a span of 9 years (1999-2007) at the municipal ward level covering the entire Norwegian population. SSB Statbank data sources were used to collect data for assessing need for and supply of municipal health care. Norwegian Social Science Data Services (NSD) data sources were used to complement the data for a supply variable, since SSB did not have the complete data. Additionally, data revealing the number of inpatient admissions per analyzed diagnosis groups, were collected from the National Patient Register (NPR).

5.2.1 Municipal Population Characteristics

Norway currently consists of 431 municipalities and 19 counties. More than 50 percent of the municipalities have less than 5000 inhabitants, and 12 municipalities have over 50,000 inhabitants (Kommunal- Og Regionaldepartementet , 2010). The structure of municipalities has change over the years. There are new municipalities, resulting e.g. from merged municipalities over the period covered in this study. Therefore, this study excludes the municipalities that have been subject to changes, in order to avoid overlapping in our analysis or bias in our results[1]. Additionally, the municipality of Kragerø (0815) was subtracted from the analysis due to incoherent increases for diabetes, ischemic and other diagnoses for the years 2007. Consequently, the study population of this analysis was reduced to 427 municipalities with a mean population of 10597,82 (table 4). Nevertheless, the size of population for the analysis of utilization of specific diagnose-groups in terms of inpatient admissions remains valid.

5.2.2 Studied populations criteria and unit of specialist use measure

The type of diagnose groups were chosen to include chronic diseases, treatments that can possibly be transferred to the municipalities, and not least based on the degree of utilization of specialized health services (SHS). The data was collected for the whole population of diagnose-groups, and additional data with the same diagnose-groups was collected with a

1 The municipalities that were excluded in the analysis are in the appendix III.

limited age group (80 years of age and over) using the International Classification of Diseases system (ICD-10) to categorize them2. The Information about the utilization of SHS from SSB from the years 2000 and 2007 was used to select the diagnose-groups, but was however not used as a data source.

The diagnose-groups of patients used in this study are diabetes mellitus, episodic and paroxysmal disorders, ischemic heart diseases, influenza and pneumonia and dorsopathies. Diabetes Mellitus includes diseases such as: in type diabetes mellitus I and in type diabetes mellitus 2. Episodic and paroxysmal disorders include among others: epilepsy, cerebrovascular diseases and migraine. Ischemic heart disorders consist among others of angina pectoris and heart attack. Dorsopathies includes the upper and lower back pain health problems[3].

Some of those groups are to a certain extent chosen randomly as it was difficult to decide unequivocally which groups can be treated at the municipalities. This study assumes that they can represent a reduction of the utilization of SHS at hospitals and that there is a possibility of substitution. Not the least, a number of these diagnose groups are chronic diseases, which need more coordination of health services, and are a substantial burden in the health sector. In the introduction, it was pointed out that this study is part of a co-work with another student. His analysis uses other diagnose groups, but the two analyses maintain two groups in common, which are diabetes mellitus and ischemic heart diseases. The unit of measurement of utilization of SHS in terms of diagnose-groups is hospital inpatient admissions. This measure mirrors a part of the problem that the coordination reform wants to address: to reduce the pressure on hospital caused by unnecessary inpatient admissions, which is related to the reform's economic incentives, like the municipal copayment arrangement (St.meld.nr.47, 2008-2009).

5.2.3 Measuring the need for health care of specialized health services

Previous empirical analyses of utilization were used as a reference to choose the need-variables. These studies tested different demographic and socio-economic factors that might have effects in the use of health services, or used assumptions based on statistics of health

2 In the appendix I these diagnose groups are described in more detail, including pathologies and other facts.
[3] All the diagnoses that included in these diagnose-groups classified according to the *International Statistical Classification of Diseases and Related Health Problems (ICD-10).)* are in the appendix II.

care consumption to include need for health care factors in their analysis. An earlier report from HOD called "*Fordeling av inntekter mellom helseforetak*" [The Distribution of Income between Health Authorities] (NOU.2008, 16-18) is also used as a reference in this thesis to gather factors of need. However, factors such as "violence policy reports" and "sosialhjelp" [social security] cases are not included here, as the first is not relevant for the analysis and the latter might overlap with gross income. In sum, need for health care factors are chosen here with the aim to also capture important aspects of social and economic circumstances (Nerland, S & Hagen, T.,2008:51; Carr-Hill, R et al.1994: 38-46; Gravelle, H et al. 2003:992-994)

Gross Income: This variable is derived from the income average of households before deductions for income tax. This variable describes the means from self-reporting residents of 17 years old or over in NOK adjusted for 10000 NOK[4] (SSB.2010b). The analysis assumes that higher earning households might have a lower tendency to utilize specialized health services (SHS) (Nerland, S & Hagen, T, 2008: 52).

Population between 67-79 years (population, 67 - 79): Proportion of the population between of 67 and 79 years old age group per 1000 inhabitants. It is assumed that the higher the proportion of 67 - 79 years, the higher the utilization of SHS (Nerland, S & Hagen, T, 2008:52; NOU.2008:16-18).

Population with 80 years of age and over (*population, 80+*): Proportion of 80 years of age and over per 1000 inhabitants. The same assumption applying to the population between 67 and 79 years of age applies for this need factor.

Mortality: Proportion of mortality. It is assumed that the higher the proportion of mortality the higher might be the utilization of SHS (Nerland, S & Hagen, T ,2008:52; NOU.2008:16-18). Levels of morbidity fluctuate with individual's age and sex, however this is out of the scope of this study (Car-Hill et al.1994: 39).

Disability: Proportion of disabled and handicapped in inhabitants between 18 and 66 years of age. This variable expresses the amount of persons who receive national social insurance disability pension (finansdepartementet.,1999) Here, it is presumed that the use of SHS increases as the percentage of disabled increases (NOU.2008:16-18).

4 Changes are done for debt and taxable net fortune for income in 2005 because of errors in 04.30.2008. There is a lack of information for the municipality Bø (0821) in 2006.

Unemployment: Proportion of persons without a job. It is assumed that the higher the number of unemployed inhabitants, the higher the utilization of SHS (NOU.2008:16-18).

Low Education: Proportion of inhabitants with primary and secondary school. This analysis assumes that inhabitants without high school or university education might consume more SHS (NOU.2008:16-18).

Immigration: Proportion of first- and second generation immigrants, except European immigrants and immigrants from Turkey. It is expected that a higher the percentage of immigrants, has a positive effect on the utilization of SHS (Car-Hill,R et al.1994: 46)

Summer temperature: Average summer temperature. It is assumed that there is a correlation between climate, geographical factors, and the use of specialized health services (NOU.2008:16-18).

5.2.4 Measuring the supply of health care

As explained earlier, the utilization of specialized health services also depends on non-need variables. A relative big group of supply variables is created with the purpose to capture the effect of varying the provision of health services for the study populations. Accordingly, this analysis includes the provision of health care professionals at the municipalities, the provision of nursing homes and residential institutions, and other variables that describe the health care supply side.

As the utilization of specialized health services is expressed in terms of inpatient admissions to hospitals (HA) for the chosen diagnose-groups, the variation both within and between the supply of health services at hospitals, is an endogenous element to the competing supply of primary care (non-need explanatory variables of supply), and for the studied populations. To reconcile this effect, this thesis follows Hagen (2009) and Gravelle et al (2005) by using dummy variables for HF. Hence, the use of dummy variables in this case is characteristic of "fixed effects"-analysis (Terje, H.Hagen, T, 2009:10). Dummy variables are also used to offset the positive tendency on the volume of patients, and other growing tendencies in other variables. This is explained in greater detail in section 5.3.2.

Besides, another supply factor is distance to the hospitals (HF). This factor is assembled by using the mean distance measured in kilometer units, which describes the distance between the city centre of a patient's municipality and the nearest hospital. The underlying assumption

of this variable is that the longer the travel distance, the lower the utilization of specialized health services. This variable is called travel distance (Hagen, T & Nerland, S & Hagen, T.2008: 49,50). The supply variables were adjusted to the total population in each municipality, and adjusted for 1000 inhabitants before the analysis was run. The expected behavior for the supply variables is based on the research problem and earlier studies described in the previous section 4.1.

Other variables such as private hospitals and GP hospitals (Orland, Hallingdal Skjukestugu, Sykestuer[5]), are included in the analyses as categorical variables. Private hospitals are included in all the analyses while the latter variables are only included in an extended analysis of the total population of ischemic heart diseases. In order to capture the effects in the utilization of specialized health services (SHS) that "hospitals fixed effects" do not capture, a variable that express the coverage of private hospitals is used. Besides, the use of GP hospitals can capture the influence on the utilization of SHS that the other explanatory variables of supply like "total residents" do not detain.

In terms of inclusion and exclusion of explanatory supply variables, the analyses include those variables that had higher correlation with the diagnose-groups chosen, compared to the many other variables that were collected from the database, which presented lower correlations - such as municipal salary costs. In addition, the analyses excluded those variables that might overlap with the variables used, such as places in institutions and nursing homes. The use of three models serves as a way to test the stability of the results. The supply variable physician coverage is present in all three models, together with the variable social nursing and care coverage, total residents (both home- and institutional residents), and recipients, respectively.

A further explanation of the study's explanatory supply variables, including its predictive behavior, is described in the following table 1.

[5] The majority of the "sykestuer are located in the North of Norway. Specially approx. half of them in Finnmark.

Table 1Explanatory variables for provision of specialized health care. Level M: municipality

Variable	Description and source	Predictive behavior
Home Residents within Nursing services	Proportion of total residents in dwellings for elderly and disabled within nursing service per 1000 inhabitants, level M; SSB Statbank	Negative
Home Residents within Nursing services, 80+	Proportion of 80 years of age and over residents in dwellings for elderly and disabled within nursing service per 1000 inhabitants, level M; SSB Statbank	Negative
Institutional residents within nursing services	Proportion of total residents in institutions per 1000 inhabitants, level M; SSB Statbank	Negative
Institutional Residents within nursing services, 80+	Proportion of 80 years of age and over residents in institutions per 1000 inhabitants, level M; SSB Statbank	Negative
Municipal Recipients within Social and Nursing Care	Proportion of recipients for/of municipal nursing and care services per 1000 inhabitants, level M; SSB Statbank	Negative
Social nursing and Care, Man-Years	Proportion of nursing and care man-years per 1000 inhabitants, total, level M; SSB Statbank	÷
Physicians, Man-Years	Proportion of physcicians man-years per 1000 inhabitnats, total, level M; SSB Statbank	÷
Private hospitals	Categorical variable label with 1 in the presence of private hospitals and 0 when no hospital is present at the municipalities	÷
GP hospitals	Categorical variables (Orland, Hallingdal S., Sykestuer). Label :0/1. The value of one is enabled when they are in the municipality catchment areas	Negative

5.3 Method

5.3.1 The regression analysis

Generally, different statistical methods are interested in averages, and in the embedded variations of those averages. In order to provide inferences about those averages and the nature of variability, an arrangement of unknown parameters in a linear model can be used (McCulloch, C & Searle, S.2001:1). Multiple regressions are normally used to discover the simultaneous effect of several exogenous variables on a dependent variable using the least square principle. This analysis was based on a multiple regression analysis. However, by testing for one of the assumptions, this type of statistical method required the statistical analysis to be extended to a weighted least-squares regression. Part of this section is going to discuss the results produced by a multiple regression analysis in order to introduce the weighted least-squares regression. Thus, in principle, the results and methods to produce inferences are more or less the same (Newbold, P et.al.2006:455-457).

Several variables, including the studied population (5 diagnose-groups measured by admissions units) were used to test, estimate, and confirm the research question stated in the section 4.1 by running them in a SPSS program.

Assessing the assumptions of the multiple regression analysis

The validity of a multiple regression analysis depends on a set of assumptions that must be verified before inferences from the analysis are done. Those assumptions include size of the sample, normality, linearity, homoscedasticity, and the independence of residuals. The size of the sample has to do with the degree of generalizability. If using too small samples, it is not possible to generalize. As the sample in this study uses the total population for the number of admissions of diagnose-groups at hospitals nested to the corresponding municipalities, this analysis fits for inference of generalizability. The data collected from the NPR from 1999-2007 provided 3843 cells. This ensures the power of the model to produce significant estimates and results (Pallant, J.2007:148).

The assumption of *normality* is complied with through looking at the Normal Probability Plot (histogram) of the standardized regression residuals and the scatter plot; and by looking for kurtosis and skeweness in the output of descriptives. The kurtosis and skeweness-values and also the plots as related to the diagnose-groups of 80 years of age and over, might entail that the normality assumption is violated (Pallant, J.2007:56). However, this is a common phenomenon in social sciences. Therefore, this study instead uses the central limit theorem which states that the sum of the random independent variables in a large number of observations, with same distribution, provides an approximate normal distribution (Newbold, P et.at.2006:243).

Assessing the assumption related to the independent variables, $x_k i$, it is assumed that these are fixed numbers. That is, that they are independent from the error terms, εi*'s.* In the case when they are highly correlated (>0.70), the estimated coefficients for the $x_k i$, will provoke a variance leading to the phenomenon of *multicollinearity.* With the aim to avoid multicollenarity, a Pearson correlation test (r) was run. This analysis aimed to retain independent variables that lead to a correlation lesser to r <0.7. However, three variables exceed this level of r: mortality, population between 69 and 79 years of age, and the population of 80 years of age and over. These had a r <0.8 (Pallant, J.2007:155,101; Newbold, P et.at.2006:464,561).

The assumption of *linearity* is explored by the Normal P-P plots, expecting that the observed value of the scores lie in a moderately straight line. The plots explored by running the multiple regression analysis varied with the diagnose-group admissions studied. Again, in social science, it is not plausible to produce scores that lie in a straight line. Therefore, the

results from the plots are seen as fulfilling the assumption (Pallant, J.2007:155,101; Newbold, P et.at.2006:464). Additionally, the dataset was revised for outliers. There was incongruence in the value for the municipality of Kragerø, 0815, as mentioned previously.

When there is no independence between errors E(εi,$\varepsilon_t \neq 0$), this leads to the problem of *autocorrelation,* or serial correlation. This may happen when time-series data are used. As this analysis uses a span of nine years, it was logical to check this assumption by using a Durbin-Watson test. When the d (Durbin Watson) value is greater that 2 it signifies that there is a negative correlation between the adjacent residuals, while a value below 2 signifies a positive correlation (Field, A.2008). By running the multiple regressions, the analysis got d values between 1, 3 and 1,8 which are in the preferable range, indicating that there is not autocorrelation in the case of the analysis of the total population. The d values were different when the analysis was done for the population of 80 years of age and over, and the results and estimates should therefore be considered as conservative.

Finally, the assumption of *homoscedasticity* was checked by exploring the scatter plot after running the regressions. The homoscedasticity assumption expects that the error terms, εi, shall be random containing a mean 0 and the same variance, that is V(εi)= σ^2 for all the observations, *i*. This assumption was violated in many of the diagnose-groups in the analysis, consequently implying the presence of the *heteroscedasticity* phenomenon. Thus, the standard errors, εi, were biased since the variance between them was not constant (Pallant, J.2007:155,101; Newbold, P et.at.2006:464). The method called "weighted Least Squares regression" was used as the most appropriate statistical analysis given the objective of the study. In the next section, this regression analysis and the reasons for using this method will be discussed.

Extending Linear Regression: Weighted Least Squares

It is not appropriate to use Ordinary Least Squares (includes multiple regression) when the phenomenon of heteroscedastycity is present. This statistical method gives an equal weight to all the observations, when there actually are remote observations that create a disturbance in the variance offsetting the effect particularly dense observations. In this case, the disturbance in the variance occurs because the studied populations aggregated in the municipalities in some geographical areas contain less information than others. In this scenario, information means parameter estimates. For instance, the amount of ischemic inpatient admissions is

much larger in the municipality of Oslo than in the Mo i Rana municipality. Hence, by weighting those equally the analysis would miss important information on ischemic admissions in the Oslo municipality (Willet, J & Singer, J.1987; NIST.2010).

The weighted Least-squares (WLS) regression downplays the disturbance in the variance from those remote observations by providing an additional weight[6], wi, which is inversely proportional to the square magnitudes of the observations. Applying these weights in the re-fitted model of the regression by WLS, to the studied populations and to the explanatory parameters, different weights will be assigned to all of the different observations, thereby recognizing those observations that are stronger than the others (Willet, J & Singer, J.1987; NIST.2010). Comparing the municipality of Oslo with a weight of 0, 11112 and Mo i Rana with 0, 00558, it is clearly showed how this model operates. The WLS criterion used to reduce the Least-square variance to obtain the estimated parameters is:

$$Q = \sum_{i=1}^{n} w_i[y_i - f(\vec{x}_i; \vec{\beta})]^2 \qquad (6.1)$$

Where $\hat{\beta}_0, \hat{\beta}_1, \cdots$ illustrate the weighted estimators used, as "variables" in the refitted model of regression are no longer the true values of the parameters. *Y*i, represents the studied population and parameter estimators, x_i and the wi, are considered as constants (NIST.2010).

5.3.2 The Empirical Model

The following WLS estimated model for the studied populations was created after the assumptions and the statistical tool were assessed. This applies to the analysis regarding the entire studied populations (5 diagnose-groups) and an extension of analysis for the 80 years of age and over population. This also reflects the algebraically function (3.2.2) developed in section 3.2:

$*\boldsymbol{Y}_m = *b_0 + *b_1 Needs_m + *b_2 Supply_m \ldots + *b_4 Dummy_H + *b_5 Dummy_t + *b6 Dummy p * e_m$ (6.2)

[6] To calculate this weight, the analysis calculate the total population from the data set by using the mean (10597,82 inhabitants) and the number of municipalities (427). This yield a total population of 4525269,14 inhabitants. By dividing the total population and multiplying it with each of the municipality populations, the weights are obtained

This model is meant to capture the marginal effect of utilization for somatic specialized health services (***Ym*) for a diagnose-group, i, in the municipality, *m,* which is a result of the changes in the explanatory variables in the WLS regression function. $*b_0$ is the intercept estimator and $*b_{1\ldots5,}$ are the estimated coefficients for each of the parameters estimators. Those estimated coefficients can be analyzed independently to produce inferences of its predictive behavior while controlling for the simultaneous effect of the other independent variables (Newbold, P et.at.2006:455-457). $Needs_m$**,** denotes a vector of the municipalities need/demand side variables such as gross income and mortality, and $Supply_{m,}$ is a vector of the municipalities' supply variables such as physicians' man-years and travel distance. $Dummy_H$ is a dummy variable vector for the Health Authorities where the municipalities were nested while $Dummy_p$ is a dummy for the private hospitals. $Dummy_t$ is a vector of dummy variables for the period/years from which the observations were collected The symbol $*e_m$ denotes the error term in the municipality ward and * symbolizes the weights, w_i, applied to the WLS regression function. The use of additional dummy variables for GP hospitals will be added in one analysis only (ischemic heart diseases). This variable is not depicted in the algebraically function, but in the case of this analysis, it adds to the function. Next, the reasons for the use of the dummy variables is going to be explained.

Fixed Effects in the empirical model

There are other factors that may entail a potential confounding when the effects of utilization for somatic health services are evaluated. Some constraints might influence people's health. People's behavior depends on e.g. the institutional and social context of their workplace or geographical area. People live within and relate to administrative units like municipalities, which include hospitals and other health institutions, and in social units such as families. Such units embody constraints that influence people's health simultaneously and together with the physical environment (Alastair L & Groenewegen, P,2003). For that reason, the culture, routines and associated efficiency in hospitals or units within them, are assumed to have an effect on the utilization of somatic services for the diagnose-groups considered in the study. This harks back to the discussions of constrains on actors in section 1.3.2. One must control for these factors because they are in one way or another connected to the municipality populations. This is done by using fixed-effects dummy variables. Dummy variables (0/1) for 24 HAs included in the variable HFNR are implemented to model the supply side when comparing to the reference values. The same was done for private hospitals. Thus, those

variables capture the heterogeneity *between* the municipalities *within* the HA/private hospital catchment area using as a reference the Akershus Universitetsykehus HA, based on a study done by Nerland, S and Hagen, T in 2008 (2) (Hagen, T.2009). Fixed effects, dummy 0/1, for the years 1999-2007 were also used to capture the unobserved and observed time constant variables by using the year 1999 as the dummy reference. Even more, capturing *within* effects of the time-varying variables, give the opportunity to make inferences of those time effects (Martinussen, P & Hagen, T.2009:13).

5.4 Descriptive statistics

The tables of descriptive statistics clearly show that the diagnose-group with more inpatient admissions is ischemic diseases, both in the total population of diagnose-groups and for diagnose-groups with 80 years of age and over. The diagnose-group with least inpatient admissions is dorsopathies. It is also important to note, that the population of 80 years of age and over, has a higher proportion of individuals diagnosed with the diseases or disorders used in this investigation, giving more inpatient admissions than the rest of the diagnose-groups population.

Table-2 Descriptive statistics for studied variables (disease- groups) standardized per 1000 inhabitants from 1999 to 2007 for all municipalities (municipality level: Valid N=3843)

Variables	Description	Min.	Max.	Mean	Std. Dev.	Skew.	Kurtosis
E10-E14	Diabetes mellitus	.00	30,7	1,53	1,47	5,21	61,81
G40-G47	Episodic and Paroxysmal disorders	.00	21,85	4,26	2,31	1,16	2,68
I20-I25	Ischemic heart diseases	.00	48,75	12,89	5,92	8,89	4,52
J10-18	Influenza and pneumonia	.00	20,79	4,85	2,24	1,16	3,55
M40-M54	Dorsopathies	.00	25,93	3,18	1,92	3,80	36,93

** These studied populations are measured in terms of inpatient admissions per 1000 inhabitants*

Table 3 Descriptive statistics for studied variables (disease groups) with80 years of age and over standardized per 1000 inhabitants from 1999 to 2007 for all municipalities (municipality level: Valid N=3838)

Variables	Description	Min.	Max.	Mean	Std. Dev.	Skew.	Kurtosis
E10-E14,80+	Diabetes mellitus- population with 80 of age and over	.00	58,82	3,61	5,48	3,1	17,02
G40-G47,80+	Episodic and Paroxysmal disorders - population with 80 years of age and over	.00	137,93,	7,38	7,79	3,24	33,14
I20-I25,80+	Ischemic heart diseases- population with 80 years of age and over	.00	232,56	49,79	27,45	1,42	4,96
J10-18,80+	Influenza and pneumonia - population with 80 years of age and over	.00	428,57	33,73	21,01	2,83	38,16
M40-M54,80+	Dorsopathies- population with 80 years of age and over	.00	52,63	3,02	4,73	3,03	16,56

**** These studied populations are measured in terms of inpatient admissions per 1000 inhabitants***

Table-4 Descriptive statistics for explanatory variables of socio- economic circumstances, demographic need and distance from 1999 to 2007 for all municipalities (municipality level: Valid N=3628)

Variable	Minimum	Maximum	Mean	Std. Dev.	Skew.	Kurtosis
Total population	209,00	548617,00	10597,82	30609,42	12,30	187,71
Total Population with 80 years of age and over	13	24556	474,47	1376,03	13,27	212,97
Population, 69 and 79	43,55	183,31	100,05	20,93	0,16	0,03
Population, 80+	16,02	136,11	53,36	15,98	0,25	0,31
Mortality	2,22	29,01	10,88	3,37	0,81	1,43
Disability	17,17	129,97	67,76	18,47	0,38	-0,38
Unemployment	2,04	111,02	18,87	15,65	2,23	5,08
High school	136,25	541,94	293,68	59,60	0,60	0,43
Immigrants	0,00	171,02	15,66	14,81	3,46	21,77
Gross income per 1000 NOK	0,00	656,80	239,57	42,52	0,74	4,89
Summer temperature	6,27	15,97	12,93	1,74	-4,94	0,29

** These studied populations are adjusted per 1000 inhabitants, except the first two variables (total)*

Table-5 Descriptive statistics in terms of frequency for the categorical variables, private hospitals and GP hospitals (municipality level Valid = 3780)

		Private HA		Hallingdal		Orland		Sykestuer	
		Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Valid	**0**	3645	82,1	3726	83,9	3726	83,9	3555	80
	1	135	**3**	54	**1,2**	54	**1,2**	225	**5,1**
	Total	3780	85,1	3780	85,1	3780	85,1	3780	85,1
Missing	**System**	661	14,9	661	14,9	661	14,9	661	14,9
Total		4441	100	4441	100	4441	100	4441	100

Table-6 Descriptive statistics for explanatory variables of supply and alternative explanatory variables of it. From years 1999 to 2007 for all municipalities (municipality level Valid N=3084)

Variables	N	Minim	Max.	Mean	Std. Devia.	Skew.	Kurt,.
Home residents within nursing services (1000 inhabit.)	3270	0,00	78,39	13,17	6,56	1,07	4,76
Institutional residents within nursing services (1000 inhabit.)	3395	.00	61,10	11,67	5,77	0,86	3,20
Physicians man-years (per 1000 inhabit)	3829	0,00	4,87	1,12	0,42	1,78	6,13
Social nursing care Man-years (1000 inhabit.)	3837	0,00	113,91	28,21	9,91	1,64	7,24
Places in Institutions (Per 1000 inhabit.)	3288	0,00	46,38	12,00	5,77	0,93	1,58
Places for Home and Nursing care services (Per 1000 inhabit)	3286	0,00	38,28	10,76	5,20	1,04	2,12
Recipients within social and nursing services (Per 1000 inhabit.)	3306	0,00	129,93	55,87	17,50	0,48	0,45
Travel Distance	3780	2,00	353,00	57,35	56,71	1,75	3,79
Number of HA	3780	1,00	24,00	13,13	6,91	-0,21	-1,13
Weight inhabitants	3843	0,00	0,12	0,00	0,01	12,30	187,70
Total Residents: Nursing Homes and Institutions within nursing services, 80+ (Per 1000 inhabit.)	3307	.00	1368,42	113,03	0,69	0,43	5,030

6 RESULTS: Utilization of Specialized health services

The following part contains the analysis of the total population and the analysis limited to an 80 years of age and over population for the 5 diagnose-groups selected in this study. It furthermore includes an extended analysis of the ischemic heart diseases group with the GP hospitals. The three models from section 5.6 are used to test the stability of the results. The predictions following the estimates will in this way be controlled for versus the simultaneous effects of the other variables.

6.1 Total Diabetes Mellitus population analysis

In general, the results from the WLS regression show that the estimates (β-coefficients) for the change of the proportion of diabetes-group inpatient admissions are not strong, even though there are effects in the variables that express the needs and the supply for the diabetes population. The R-square statistics vary between the values 0, 29 and 0,324 where the values of needs and supply of municipal health services account for approximately 30 % of the variance in the utilization of SHS. It should be noted that this thesis is not seeking to develop a model that best fit the data.

Following the estimates of the explanatory variables of needs, effects in terms of mortality, disability, low education, immigration, gross income and summer temperature were significant at 1 % and 5 % of statistical significance level (p-value=0, 01; p-value=0,05) in the three models. The population between 69 and 79 years of age, and unemployment had positive effects in the variation of inpatient admissions. In the case of summer temperature, the proportion of inpatient admissions will decrease with 0,071 per 1000 inhabitants if the temperature increases by one degree (Celsius), controlling simultaneously for the effects of the other variables.

According to analyses as a whole, mortality can be interpreted as an explanatory variable that shows the use of SHS in one way or another during the last phase of live (Hagen, T,2009:11). In the first model, the use of specialized health services (SHS) increases with 0,033 inpatient admissions per 1000 when the proportion of mortality increases with one unit. The needs that were significant for the utilization of SHS in the case of diabetes mellitus population reflect the assumptions made in section 5.2.3

Only one explanatory variable of supply was positively significant. The proportion of municipal physicians had positive effects at a 1% (p-value=0, 01) of statistical significance. That is, increasing the coverage of municipal physicians by one man-year increases the utilization of SHS with 0,313 inpatient admissions per 1000 inhabitants using the model II. Thus, the effects of this explanatory supply variable do not support the prior stated assumption.

In spite of "total residents" not being significant, its negative estimate may provide some information about the diabetes population. It is possible that this group does not need to use a lot of SHS since these institutions and nursing homes had more coverage for some age groups during the years included in this study (Hagen, T,2009:12). However, it is likely, that there is a correlation between the "recipients" and "total residents" variable, and as a consequence this negative effect is open to discussions – some of the effects of the two were incongruent.

Travel distance was negatively significant in all the models (see table 7) , but again with very low estimates. Increasing the travel distance by one kilometer from the nearest hospital to the patient's residence will decrease the utilization with 0,001 inpatient admissions per 1000 inhabitants corroborating what was assumed in section 5.2.4. Nevertheless, the last model shows the opposite effect, with the same estimate value.

The categorical variables/dummy variable for private hospitals was significant at a p-value of 5 %. Residents in municipalities where private hospitals are located close might use more private SHS than those without private hospitals in the catchment areas. Where private hospitals are nearby, the utilization of SHS is lessened with 0,143 inpatient admissions per 1000 inhabitants according to the second model.

Indeed, the variables that express needs for health care and municipality health care supply provided evidence that there is a relationship with the utilization of those services, expressed in terms of inpatient admissions for the diabetes population. However, the physician effects and the insignificance of the other supply variables do not support the possibility of substitution. In continuation, an analysis of the utilization for this studied group will be conducted for the population of 80 years of age and over.

Table 7 Variation in utilization of specialized health services measure as the number of per 1000 inhabitants. For diabetes M. Group, Results from WLS, (Municipality level)

MODELS: DIABETES MELLITUS	**I**	**II**	**III**
Variables	**β/ Std E.**	**β/ Std E.**	**β/ Std E.**
(Constant)	**-0,330** (0,351)	**-0,255** (0,363)	**-0,265** (0,362)
Explanatory variables of Supply or equivalent factors of it			
Physicians Man-years	**0,277** (0,075)***	**0,313** (0,076)***	**0,311** (0,076)***
Social Nursing Care Man-years	**0,004** (0,003)	-	-
Total residents		**-0,002** (0,003)	-
Institutional residents	-	-	-
Recipients (Nursing home and Institutions)	-	-	**0,000** (0,002)
Explanatory variables of needs:			
Mortality	**0,033** (0,011)***	**0,036** (0,011)***	**0,034** (0,011)***
Population, 69 and 79	**0,004** (0,002)**	**0,003** (0,002)*	**0,003** (0,002)*
Population, 80+	**0,000** (0,003)	**0,001** (0,003)	**0,001** (0,002)
Disability	**0,008** (0,002)***	**0,007** (0,002)***	**0,007** (0,002)***
Unemployment	**0,004** (0,002)*	**0,005** (0,002)**	**0,005** (0,002)*
Gross Income	**0,022** (0,007)***	**0,016** (0,007)**	**0,017** (0,007)**
Low Education	**0,002** (0,001)**	**0,002** (0,000)***	**0,002** (0,000)***
Immigration	**0,002** (0,001)**	**0,003** (0,001)***	**0,003** (0,001)***
Summer Temperature	**-0,071** (0,018)***	**-0,067** (0,019)***	**-0,067** (0,018)***
Explanatory variables of supply variation:			
Travel Distance	**-0,001** (-0,001)**	**-0,001** (0,000)**	**0,001** (0,000)**
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,121** (0,042)***	**-0,143** (0,043)***	**-0,142** (0,042)***
Fixed effects (year)	Yes	Yes	Yes
R square	**0,296**	**0,324**	**0,323**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 01 **β: beta coefficient**

6.1.1 Diabetes mellitus group analysis limited to a population of 80 years of age and over

When limiting the analysis to the age group 80 years of age and over, the results show negative effects for summer temperature and travel distance in the case of the explanatory variables of needs. Summer temperature being a proxy of health needs was the only need variable that was significant, lessening the proportion of inpatient admissions with 0,230 per 1000 inhabitants by increasing the temperature with one degree Celsius.[7]

Travel distance had negative effects being the only variable from the supply side that could explain part of the variation in the use of SHS expressed in units of proportion of inpatient admissions regarding the diabetes population. The latter variable confirms the expected behavior, where longer travel distances from the patient's resident to the HA reduces the use of SHS.

The constant variable, which denotes the reference dummies for Akershus Universitetssykehus, for the year 1999, and the determinants that are not captured in this analysis, was positively significant at a 1% of statistical significance. The proportion of inpatient admissions increases with 8,005 per 1000 inhabitants in 1999. If the variation of utilization of SHS is compared with Sykehuset Østfold HA (HFNR 1), the utilization in this catchment area is reduced with 6,488 inpatient admissions per 1000 inhabitants (model I). Looking at the SHS utilization trend between the years 2000 and 2007, it has been reduced. For instance, the proportion of inpatient admissions is lessened to 6,835 (8,005-1,170) per 1000 inhabitants in the dummy for the year 2007 in model I. The next section, 6.2, will show the results of the analysis for episodic and paroxysmal disorders.

In conclusion, only one variable from the supply side and one from the need side had significant effects in this population. Both explanatory variables were also significant in the analysis of the total diabetes population providing some information of which factors influence the demand for health services. However, the results do not support the research question related to the expansion of municipality services, since the municipality supply side results do not seem to reduce the use of SHS in the diabetes-group of patients.

7 The results from this analysis are located in the appendix VI-1.

6.2 Total episodic and paroxysmal disorders population

Looking at the results, there were only two explanatory supply variables that had effects in the utilization of SHS while mortality, disability, gross income, and low education were significant at a p-value of 5%. Disability was only significant in the model I (10 % of significance) while the rest of the estimates concerning need for health care were significant in all the models. Mortality was the only variable where negative effects violated the expected assumptions for this proxy of need for health care. Hence, it is plausible that this diagnose-group consume less SHS in the last phase of life.

The proportion of inpatient admission increases with an increase in the proportion of general practitioners in primary care (physicians' man-years). Its effects were positive at a 5 % of statistical significance. In contrast, municipal social and nursing care had negative effects for the utilization of SHS with a 1% of significance in accordance with the first model. As the prior variable of supply had the opposite correlation/relationship than what was expected whereas the latter variable supports its predictive behavior, social and nursing care represents a possibility of replacement of somatic health care. However, it is important to note that this estimate do not provide solid evidence for the causality mechanisms of utilization of SHS in the case of episodic and paroxysmal disorders.

Travel distance also resulted to be significant in all the models with 1 % of significance level. The negative effects support what was expected.Looking at the R-square correlation coefficient, the values were approx. 0, 4. Thus, the variance of episodic and paroxysmal disorders measured in inpatient admissions units is explained by the variance of the explanatory variables giving a 40 % of confidence. This result is quite respectable.

Controlling for fixed effects, the constant that has the reference dummy for Akershus Universitetssykehus HA and the dummy for the year 1999, had considerable positive effects on the utilization of SHS. It indicates that more patients with this diagnosis uses hospital (HA) services. All of the dummies for HA were significant except HA 3 (Rikshospitalet, Ullevål, AHUS) and HA 15 (Helse Førde). The proportion of inpatient admissions with relationship to the HA dummies deviates from the country average represented by Akershus Universitetssykehus (HA 2) after it is adjusted for explanatory need and supply variables. For instance, the proportion of inpatient admissions increases with 2,119 (4,806 -2,687) inpatient admissions per 1000 inhabitants in the case of Sykehuset i Vestfold. The results from the

"dummy years" indicate a relatively constant and a positive effect with a 1% of significance between the years 2003 and 2007.

The estimates of physicians and the constant variable give evidence of low probability of substitution between primary care and somatic care for this population.

In the next subsection, this analysis will be limited to the population of 80 years of age and over.

Table 8 Variation in utilization of specialized health services measure as the number of per 1000 inhabitants. For episodic and paroxysmal disorders group, Results from WLS, (Municipality level)

MODELS: episodic and paroxysmal disorders Variables	**I** **β/ Std E.**	**II** **β/ Std E.**	**III** **β/ Std E.**
(Constant)	**4,806** (0,650)***	**4,577** (0,700)***	**4,630** (0,700)***
Explanatory variables of Supply or equivalent factors of it			
Physicians Man-years	**0,242** (0,118)**	**0,251** (0,125)**	**0,216** (0,125)*
Social Nursing Care Man-years	**-0,013** (0,005)***	-	-
Total residents	-	**-0,006** (0,006)	-
Recipients (Nursing homes and Institutions)	-	-	**0,002** (0,003)
Explanatory variables of needs:			
Mortality	**-0,037** (0,017)**	**-0,046** (0,019)**	**-0,042** (0,019)**
Population, 69 and 79	**0,003** (0,003)	**0,003** (0,003)	**0,002** (0,003)
Population, 80+	**0,007** (0,004)	**0,006** (0,005)	**0,003** (0,005)
Disability	**0,007** (0,003)**	**0,004** (0,003)	**0,005** (0,003)
Unemployment	**0,002** (0,005)	**0,002** (0,005)	**0,003** (0,005)
Gross Income	**-0,034** (0,014) **	**-0,033** (0,014)**	**-0,033** (0,014)**
Low Education	**0,002** (0,001)**	**0,002** (0,001)**	**0,002** (0,001)**
Immigration	**-0,002** (0,002)	**-0,002** (0,002)	**-0,002** (0,002)
Summer Temperature	**-0,046** (0,031)	**-0,031** (0,034)	**-0,033** (0,034)
Explanatory variables of supply variation:			
Travel Distance	**-0,004** (0,001)***	**-0,005** (0,001)***	**-0,004** (0,001)***
Fixed effects (HA)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,071** (0,112)	**-0,102** (0,117)	**-0,070** (0,118)
Fixed effects (year)	Yes	Yes	Yes
R square	**0,424**	**0,415**	**0,411**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

6.2.1 Episodic and paroxysmal disorders analysis limited to a population of 80 years of age and over

There were only three significant variables in these results: mortality, travel distance and the constant variable[8]. Both these need and supply side estimates showed strong significance and negative effects. The effects from the estimate of mortality did not act as expected. Hence, utilization of specialized health services decreases with 0,197 inpatient admissions per 1000 if the proportion of mortality is reduced by one unit. This result is also reflected in the results for the total population of this studied diagnose-group.

Travel distance estimates provides evidence that the geographical areas far from the HA catchment areas show less use of SHS than those close to the HA (hospitals). The prior and the present results confirm that substitution between somatic and primary care services is not likely to happen for this studied population.

In addition, the constant provides a strong and positive effect in the variation of the proportion of inpatient admissions. Hence, ceteris paribus, the use of SHS will increase with 10,459 inpatient admissions per 1000 inhabitants concerning Akerhus Universitetssykehus (HA 2) in the year 1999.. The change in the proportion of inpatient admissions is bigger in many of the HA than in the reference HA 2, showing that more patients diagnosed with these diseases are frequently admitted to hospitals. For example, the coverage at the HA 3 (Rikshospitalet and Ullevål Sykehus) increases the utilization of SHS with 11,745 (10,165 + 1,580) inpatient admissions per 1000 inhabitants[9].

Using the dummies for years to capture the trend in utilization of SHS for this population, it shows that the utilization is relatively constant between the years 2006 and 2007 at a 5% and 10% significance level in the model I after it is controlled for need and supply variables. The other years were not significant. In sum, the results do not support the expansion of health services at the municipalities concerning this limited studied group.

8 The results are illustrated in the appendix VI-2
[9] Fixed effects are illustrated in the appendix VIII

6.3 Total Ischemic Diseases population analysis

The results of this analysis are more interesting. All of the explanatory variables that express the supply of specialized health services in primary care were significant, except for "recipients" within nursing homes and institutions. The supply variable that gave results that are more remarkable was the coverage of physicians for primary care. It had a significance of 1% (p=0, 01) and stronger estimates. Increasing the coverage of general practitioners by one man-year is going to increase the utilization of specialized health services (SHS) with 1, 291 inpatient admissions per 1000 inhabitants (model I), not supporting the predictive behavior for this variable.

Quite the opposite was found, for instance, for the explanatory variable that expresses the coverage of social nursing and care services. The proportion of inpatient admissions will decrease with 0, 019 per 1000 inhabitants if the coverage of social and nursing care increases by one man-year unit at a 10 % statistical significance (model I). In the case of the explanatory variable for home residents, the effects was equally positive equally as in the case of supply of physicians. Travel distance is also a variable of the supply side. The effect of travel distance is negative and significant at a 1% of significance.

Considering the explanatory variables of needs, being between 69 and 79 years of age, disability, unemployment, low education, and summer temperature had effects at 1% of significance in all the models. The population of 80 years of age and over had a positive effect (10% statistical sig.) in the first model. All show evidence for the expected behavior. For instance, the utilization of SHS is going to increase with 0,066 inpatient admissions per 1000 inhabitants if the variable of proportion of population between 69 and 79 years of age increases with one unit. Summer temperature had negative effects in relationship with the use of SHS for patients with ischemic diseases. At any rate, these estimates are low, not providing much information on the causality of inpatient admissions, with the evident exception of summer temperature.

The previous provide evidence that the ischemic disease population has a relationship with the variables of needs. The results support what was explained in the method section, showing that the proxies of socio-economic and geographical factors reflect the needs for health care in this population.

The supply of physicians working in primary care, in fact increases the utilization of SHS. Consequently, the possibility to transfer part of the provision of SHS to the municipality level of care for patients diagnosed with ischemic diseases, is not supported by these results. In the following, the results from the limited analysis are explained.

Table 9 Variation in utilization of specialized health services measure as the number of per 1000 inhabitants. For ischemic diseases, Results from WLS, (Municipality level)

Models for Ischemic Diseases: Variables	**I** **β/ Std E.**	**II** **β/ Std E.**	**III** **β/ Std E.**
(Constant)	**1,840** (1,401)	**1,917** (1,477)	**1,918** (1,478)
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**1,291** (0,255)***	**1,330** (0,265)***	**1,355** (0,264)***
Social Nursing Care Man-years	**-0,019** (0,011)*	-	-
Total Residents	-	**0,021** (0,013)*	-
Recipients (Nursing Homes and Institutions)	-	-	**0,010** (0,007)
Explanatory variables of needs:			
Mortality	**0,033** (0,038)	**0,016** (0,039)	**0,024** (0,039)
Population, 69 and 79	**0,066** (0,006)***	**0,062** (0,007)***	**0,063** (0,007)***
Population, 80+	**0,017**(0,010)*	**0,012** (0,010)	**0,011** (0,010)
Disabled	**0,047** (0,006)***	**0,044** (0,007)***	**0,046** (0,007)***
Unemployment	**0,056** (0,011)***	**0,063** (0,011)***	**0,062** (0,011)***
Gross Income	**0,037** (0,029)	**0,035** (0,030)	**0,034** (0,030)
Low education	**0,012** (0,002)***	**0,011** (0,002)***	**0,011** (0,002)***
Immigration	**-0,001** (0,005)	**-0,003** (0,005)	**-0,004** (0,005)
Summer Temperature	**-0,361** (0,068)***	**-0,337** (0,071)***	**-0,341** (0,071)***
Explanatory variables of supply variation:			
Travel Distance	**-0,015** (0,002)***	**-0,016** (0,002)***	**-0,017** (0,002)***
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,379** (0,240)	**-0,327** (0,249)	**-0,292** (0,249)
Fixed effects (year)	Yes	Yes	Yes
R square	**0,498**	**0,497**	**0,499**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

6.3.1 Ischemic heart diseases analysis limited to the population of 80 years of age and over

The common variables used in the analysis of the total population, such as education, summer temperature and the proportion of the population of 80 years of age and over, were also significant in these results[10]. Gross income and immigration did not have effects in the previous analysis, but they were significant and its effects were positive in these results. The negative effects of the estimates provided by the proportion of population of 80 years of age and over did not support the assumption of this proxy of need. Hence, the utilization of SHS is lessened with 0,197 inpatient admissions per 1000 inhabitants if the proportion of persons of 80 years of age and over increases by one unit in the model I, with a p-value of 0, 01. Gross income in this case might reflect the equivalent significance in the explanatory variable of unemployment in the previous analysis. Unemployment was not included because it applies mostly for age populations that do not receive pension.

From the supply variables side, travel distance and municipal physician coverage are also significant in this result. The values of the estimates are stronger and have a 5% and 1% of statistical significance. In contrast, the effects of social and nursing care still negative but not significant.

The constant estimates values in the models were strong and highly significant, providing strong evidence that many of the patients above 79 years of age with ischemic heart diseases do use somatic health care services to a big extent. The dummy variables that describe the HA catchment areas indicates, *cet par*, indicate that there is less use of hospitals services (HA). The HA estimates shows more or less a negative deviation from the country average (HA 2) after it is controlled for needs and supply variables[11]. For instance, in 1999 the utilization of SHS is reduced to 53.939 (74,923 -20,984) inpatient admissions per 1000 inhabitants using as a reference the dummy HA 3 (Rikshospitalet and Ullevål). The trend of inhabitant admissions for ischemic heart diseases is quite constant between the years 2003 and 2007, but from 2000 to 2003 there is an increase in utilization of SHS by this diagnose-group.

10 The table with the results are illustrated in the appendix VI-3
[11] Fixed effects are illustrated in the appendix VIII

6.4 Utilization of specialized health services, diagnose group: Influenza and Pneumonia

The following models in table 10 describe the positive effects from various of the variables that express the needs. Mortality, population between 69 and 79 years, population of 80 years of age and over, and disability were significant at a 1% significance level (p-value=0,01) in all the models. Gross income and low education had negative effects. Also, the utilization of SHS will decrease with 0,123 inpatient admissions per 1000 inhabitants by increasing the temperature with 1 degree Celsius. The results from the needs estimates, sustain their predicted behaviors.

From the supply side, the coverage of municipal GP's had positive effects (5 % statistical significance) on the use of SHS in this studied population. The use of SHS will increase with 0,286-0,247 admissions per 1000 inhabitants (model I, II) whereas the use of health services will decrease if travel distance increase, controlling for the simultaneous effects of the other explanatory variables. The other explanatory supply variables were not significant, but its estimates were negative.

There were also positive effects (p-value =0, 01) in the constant variable in the three models. Hence, the same phenomenon that occured in prior results regarding the effects of the reference dummies (Akerhus Universitetssykehus and the year 1999), compared with the rest of the fixed effects, are likely to be reflected in this result[12].

In summary, the probability of substitution is not so plausible for influenza and pneumonia since the coverage of municipal physicians indeed increase the use of specialized health services. Next, the analysis of this diagnose-group will be extended to the age group of 80 years of age and over.

[12] The fixed effects results are illustrated in the appendiv VII.

Table 10 Variation in utilization of specialized health services measure as the number of per 1000 inhabitants. For chronic rheumatic disorders and hypertension, Results from WLS, (Municipality level)

Models for Influenza and Pneumonia : Variables	**I** **B** Std E.	**II** **B** Std E.	**III** **β** Std E.
(Constant)	**3,319** (0,624)***	**3,526** (0,661)***	**3,615** (0,664)***
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**0,286** (0,114)**	**0,247** (0,118)**	**0,266** (0,118)**
Social Nursing Care Man-years	**-0,003** (0,005)	-	-
Total residents Recipients (Nursing Homes and Institutions)	-	**-0,007** (0,006)	-
	-	-	**-0,006** (0,003)
Explanatory variables of needs:			
Mortality	**0,060** (0,017)***	**0,085** (0,016)***	**0,070** (0,018)***
Population, 69 and 79	**0,015** (0,003)***	**0,019** (0,003)***	**0,016** (0,003)***
Population,80+	**0,015** (0,004)***	**0,017** (0,005)***	**0,017** (0,005)***
Disabled	**0,015** (0,003)***	**0,014** (0,003)***	**0,015** (0,003)***
Unemployment	**0,005** (0,005)	**0,004** (0,005)	**0,003** (0,005)
Gross Income	**-0,030** (0,013)**	**-0,039** (0,013)**	**-0,033** (0,013)**
Low education	**-0,002** (0,001)**	**-0,002** (0,001)**	**-0,002** (0,001)*
Immigration	**-0,001** (0,002)	**-0,001** (0,002)	**-0,002** (0,002)
Summer Temperature	**-0,123** (0,030)***	**-0,125** (0,031)***	**-0,138** (0,032)**
Explanatory variables of supply variation:			
Travel Distance	**-0,008** (0,001)***	**-0,009** (0,001)***	**-0,009** (0,001)***
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,108** (0,107)	**-0,165** (0,112)	**-0,142** (0,112)
Fixed effects (year)	Yes	Yes	
R square	**0,344**	**0,352**	**0,349**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

6.4.1 Influenza and Pneumonia analysis limited to a population of 80 years of age and over

The effects in the explanatory variables of needs for health care such as mortality, the population of 80 years of age and over, summer temperature, gross income and low education are also significant in this analysis[13]. The effects of the variable for the population of 80 years of age and over were negatively significant (p-value = 0, 01), contrary to the analysis of the total influenza and pneumonia population. The utilization of SHS diminishes with 0,132 inpatient admissions per 1000 inhabitants if the proportion of the population of 80 years of age and over increase with one unit considering the first model. This effect did not support the expected behavior defined prior to the analysis. Moreover, the mortality estimates were stronger than in the previous analysis, where the proportion of inpatient admission increases if the proportion of mortality augments.

Regarding the explanatory supply variables, recipients in nursing homes and institutions and travel distance had negative effects. Recipients in nursing homes and institutions had a 10 % of statistical significance and a β-coefficient of -0,060, while travel distance had a 5 % significance and a β-coefficient of -0,102, in reference to model III. As the statistical significance of recipients in nursing homes and institution is not strong, inferences about possibilities of substitution need to be conservative.

Regarding the fixed effects in the results, the constant (dummy references) had positive effects. Its statistical significance was high (p-value=0,01) in all the models, and its β-coefficient was 56,057 considering the first model. Therefore, *cet par*, the variation in the proportion of inpatient admissions is bigger than the variation other estimates provide. In 1999 the utilization of SHS augmented with 56,057 inpatient admissions per 1000 inhabitants at the Akershus Universitetssykehus catchment area for the population of 80 years of age and over diagnosed with either influenza or pneumonia.

13 The results from this analysis are located in the appendix VI-4

6.5 Total Dorsopathies population analysis

Among the explanatory variables of needs, the ones that provided a 1% of statistical significance were disability and summer temperature. 5 % of statistical significance was found in the proportion of population between 67 and 79 years of age, and immigration. Variables that express factors of temperature and immigration had negative effects for the utilization of SHS in the population diagnosed with different disorders in the dorsopathies-group. The variable of immigration did not play out as expected. Conversely, disability had positive effects. It was significant at a 1% (p-value=0, 01) of statistical significance in all the models. The variable that express the proportion of population of 80 years of age and over had positive effects for the use of SHS in two of the models (p-value=0,1).

From the supply side, social and nursing care and travel distance were the only explanatory variables that were significant. The coverage of social and nursing care services in primary care reduce the utilization of SHS with only 0,008 inpatient admissions per 1000 if increased with one man-year(10% statistical significance, model I). Travel distance had negative effects and was highly significant (p-value=0, 01). This means that an increase in 1 km of travel distance from the nearest HA catchment area to the residence of the patient, will diminish the utilization of SHS with 0,003 inpatient admissions per 1000 inhabitants (p-value=0,05) according to all the models. It is also important to point out that the values of these estimates of social and nursing care and travel distance are low.

As with other results, the constant expressing the reference dummy for Akershus Universitetssykehus and the dummy for the year 1999 were considerably significant, having a p-value of 1 % and its estimates in all the models had higher and more positive values compared to the estimates of the other variables[14]. This means that people within the dorsopathies group are less likely to use health care services at the municipality health care level (primary care). Simultaneously, fixed effects from the private hospitals provided negative effects in the use of SHS and can, to a certain extent, be alternative suppliers of health services for this disease population. An extended analysis limited to the age group of 80 years of age and over will be carried out for the studied group of dorsopathies.

[14] Fixed effects results are illustrated in the appendix VII

Table 11 Variation in utilization of specialized health services measure as the number of per 1000 inhabitants. For chronic rheumatic disorders and hypertension, Results from WLS, (Municipality level)

Models for Dorsopathies: Variables	**I** β/ Std E.	**II** β/ Std E.	**III** β/ Std E.
(Constant)	**3,763** (0,520)***	**3,860** (0,560)***	**3,901** (0,557)***
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**-0,104** (0,111)	**-0,075** (0,118)	**-0,118** (0,117)
Social Nursing Care Man-years	**-0,008** (0,004)*	-	-
Total Residents	-	**-0,010** (0,005)	-
Recipients (Nursing homes and Institutions)			**0,002** (0,003)
Explanatory variables of needs:			
Mortality	**0,000** (0,016)	**0,001** (0,003)	**-0,009** (0,017)
Population, 69 and 79	**0,000** (0,002)	**0,001** (0,003)**	**0,000** (0,003)
Population, 80+	**0,007** (0,004)*	**0,009** (0,004)	**0,005** (0,004)*
Disabled	**0,016** (0,002)***	**0,015** (0,003)***	**0,015** (0,003)***
Unemployment	**-0,004** (0,004)	**-0,003** (0,004)	**-0,002** (0,004)
Gross Income	**-0,014** (0,010)	**-0,014** (0,010)	**-0,014** (0,010)
Low education	**0,000** (0,001)	**0,000** (0,001)	**0,000** (0,001)
Immigration	**-0,003** (0,001)**	**-0,004** (0,002)**	**-0,003** (0,002)**
Summer Temperature	**-0,125** (0,027)***	**-0,131** (0,029)***	**-0,129** (0,028)***
Explanatory variables of supply variation:			
Travel Distance	**-0,003** (0,001)***	**-0,003** (0,001)***	**-0,003** (0,001)***
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,123** (0,062)**	**-0,123** (0,066)*	**-0,116** (0,065)*
Fixed effects (year)	Yes	Yes	Yes
R square	**0,396**	**0,396**	**0,394**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

6.5.1 Dorsopathies group analysis limited to a population of 80 years of age and over

Following the explanatory variables of needs, immigration was the only explanatory variable of needs that had effects in the utilization of SHS. This variable was significant also in the prior results concerning the total population. The effects were positive with a statistical significance of 1% and 5% through the 3 models[15].

Three explanatory variables from the supply side had effects in the utilization of SHS by the population of patients within the dorsopathies group. The coverage of physicians and nursing care had contrary effects. The coverage of primary care physicians increase the use of SHS with 3,88 inpatient admissions per 1000 inhabitants if the proportion of physician man-years increase with one unit (5 % statistical significance; model II). In contrast, the coverage of social and nursing care at the primary care level reduces the use of SHS with 0,028 inpatient admission per 1000 if the proportion of nursing care man-years increases with one unit (5 % statistical significance, model I). Travel distance also had negative effects in the use of SHS with a 1% of statistical significance. The change in the proportion of inpatient admissions declines with 0,011 inpatient admissions per 1000 inhabitants if the travel distance augments with one kilometer from the HA catchment are to patients residence (model I).

As in the total population, fixed effects were significant. The constant variable embedding as a reference the country average Akerhus Universitetssykehus (HA 2) and 1999 dummy year had a statistical significance of 5% in all the models[16]. Looking at model I, the change in the utilization of SHS varies with 3,510 inpatient admissions per 1000 inhabitants after it is adjusted for variables of need and supply. The estimate coefficients for the HA fixed effects had positive effects (HA dummies that were significant) which deviate from the country average. For instance, the variation in the proportion of inpatient admissions in the HA 18 (St Olavs Hospital HA) catchment area accounts for 4,852 (3,510 + 1,342) inpatient admissions per 1000 inhabitants. This evidences the use of SHS in this population.

In short, both the coverage of social and nursing care and the travel distance might provide some information about the possibility of substitution of SHS between somatic health care and primary health care. However, the effects from the municipal physician's coverage and the one from the constant do not support this possibility, as the physicians are the ones that

15 The results from this analysis are placed in the appendix VI-5
[16] The fixed effects results are illustrated in the appendix VIII.

can decide to refer patients to specialist health care or not, the results do not support the stated research question.

6.6 Extension of utilization analysis for the total population of Ischemic Heart Diseases

This extended analysis aimed to discover the possible effects from GP Hospitals such as Norland Medisinsk Senter, smaller GP hospitals -"*Sykestuer*"- and Hallingdal Sjukestugu in the ischemic heart diseases population. This result embody only one model which includes the same variables used in the analysis of the total ischemic heart diseases population from the first model, excluding fixed effects of private hospitals.

The effects found in the estimates of the explanatory variables of needs and supply were the same as in the previous results in this diagnose-group. GP hospitals Hallingdal Sjukestugu and Ørland Medisinske Senter were not significant, but its estimates were negative. In contrast, *Sykestuer* had relevant negative effects with a statistical significance of 1%. That is, the use of SHS reduces with 2,592 inpatient admissions if the coverage of this GP hospital is expanded in one unit. The information provided from this explanatory supply variable gives better evidence of the opportunity of relocation of somatic health services than the coverage of primary care physicians (GP's).

Table 12 Variation in utilization of specialized health services measure as the number of per 1000 inhabitant and extended with the supply of GP hospitals for ischemic diseases, Results from WLS, (Municipality level)

Models for Ischemic Diseases: **Variables**	**I** **β-coefficient/ Standard Deviation**
(Constant)	**1,652** (1,412)
Explanatory variables of Supply	
Physicians Man-years	**1,246** (0,255)*******
Social Nursing Care Man-years	**-0,019** (0,011)******
Sjukestugu	**-0,964** (0,934)
Orland	**-0,791** (0,633)
Sykestuer	**-2,592** (0,577)***
Explanatory variables of needs:	
Mortality	**0,023** (0,037)
Population, 69 and 79	**0,065** (0,006)*******
Population, 80+	**0,016**(0,010)*
Disabled	**0,049** (0,006)*******
Unemployment	**0,059** (0,011)*******
Gross Income	**0,032** (0,029)
Low education	**0,012** (0,002)*******
Immigration	**-0,001** (0,005)
Summer Temperature	**-0,357** (0,068)******
Explanatory variables of supply variation:	
Travel Distance	**-0,011** (0,002)*******
Fixed effects (HF)	Yes
Fixed effects (year)	Yes
R square	**0,501**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1

7 DISCUSSIONS

In general, the analyses in this study have intended to shed light on factors that influence the utilization of specialized health services (SHS) in the somatic level of health care. Specially, the interest of this research project is in the supply of municipal health care services (primary care) to see whether it can substitute the provision of specialized health services by hospitals (somatic health care) for the diagnose-groups of populations chosen for this study. In the next subsection, the findings from the analyses will be discussed.

7.1 Main Findings

There were not enough evidence of substitution or an expected extent of substitution emanating from the analyses, since the supply of municipal health services does not seem to sufficiently reduce the utilization of specialized health services (SHS). It was found that the provision of municipal physicians in fact induce positively the demand for SHS. However, negative effects in the utilization of SHS from the supply of social and nursing care might represent a weak substitution of somatic health care services. This is because the estimates, and at times the significance of this explanatory variable, were weak compared with the estimates of the prior explanatory variable of supply. The other explanatory variables of supply, such as total residents, had weaker negative effects than the supply of social and nursing care, and its significance do not provide enough evidence of a possibility of substitution. Even more, the behavior of its estimates varied across the analyses run through the five groups (total population) in the analyses.

The demographic and socio-economic variables used as proxies of health care needs at the municipal level gave significant effects more frequently. The effects of those factors varied throughout the analysis, providing information on how the health status in the diagnose-group populations might vary depending on their demographic characteristics and the socio-economic status provoking consequent health care needs. Not all of them played out as expected. For instance, gross income had positive effects in the results of diabetes mellitus, mortality had negative effects for episodic and paroxysmal disorders, and unemployment had negative effects in the dorsopathies diagnose-group. It was therefore important to control for these factors in the analyses, given that the supply of municipal health care services is expected to vary also depending on the health care needs in the municipal populations. A resumé of the effects across the different diagnose-groups will now be further discussed.

7.2 Discussions of the effects

The following table illustrates the different effects provided from the results of the explanatory supply variables through the five diagnose groups in the case of the total population analyses and in the limited analyses for the population of 80 years of age and over.

Table 13 *The qualitative effects of the studied populations expressed in proportion of inpatient admissions per 1000 inhabitant. Supply influence on use of SHS*

Total Diagnose group Population					
Diagnose-groups : Explanatory Variables of Supply	**E10-E14**	**G40-G47**	**I20-I25**	**J10-J18**	**M40-M54**
	Sig. effects	*Sig. effects*	*Sig. effects*	*Sig. effects*	*Sig. effects*
Physicians man-years	+	+	+	+	
Social and Nursing Care Man-years		-	-		-
Total Residents			+		
Recipients					
Private Hospitals	-				-
Hallingdal GP hospital					
Orland GP hospital					
Sykestuer (GP hospitals)			-		
Travel Distance	-	-	-	-	-
Limited Diagnose Group Population					
Diagnose-groups : Explanatory Variables of Supply	**E10-E14**	**G40-G47**	**I20-I25**	**J10-J18**	**M40-M54**
	Sig. effects	*Sig. effects*	*Sig. effects*	*Sig. effects*	*Sig. effects*
Physicians man-years			+	+	
Social and Nursing Care Man-years					-
Total Residents					
Recipients				-	
Private Hospitals					
Travel Distance	-	-	-	-	-

**E10-E14: diabetes Mellitus/ G40-G47: episodic and paroxysmal disorders/ I20-I25: ischemic heart diseases/J10-J18: Influenza and pneumonia/ M40-M54: Dorsopathies.*
**Municipal ward Level*

In the first part of the table, for the total diagnose group population, the significant positive effects from the estimates of the *coverage of municipal physicians* had a more or less strong significance and are present in all the diagnose-groups studied, except for the group of dorsopathies. These estimates provide a higher variation in the proportion of inpatient admissions to hospitals compared to social and nursing care, total residents, and recipients (explanatory variables of supply).

According to the effects from limited populations of 80 years age and over, there were fewer significant effects in the utilization of SHS provided from the estimates of the explanatory variables, compared with the results in total diagnose-populations (see table 13). *The coverage of municipal physicians had positive effects in this population, but they were only significant in two of the results of the diagnose-groups*. The values from the estimates in the case of ischemic heart diseases were higher than the estimates from the total diagnose-group population results. Hence, there is powerful evidence that there is no substitution from somatic health services towards municipal health services with reference to the coverage of municipal physicians in the two main analyses.

These findings are not supportive of one proposals of the coordination reform related to the expansion of municipality physician coverage. Other studies of small area variation in use of health care in the UK, have also found positive effects in the provision of *primary care physicians* (GP's) associated with variation of hospital admissions and use of inpatient facilities (Gravelle, H. et. al. 2003:999; Car-Hill, R et. al.1994:89). A study conducted by Gravelle (2003) aimed to provide information on how to allocate funding, while Car-Hill's study (1994) developed a formula for distributing NHS revenues. Also a Danish study made by Bech & Lauridsen (2008) in order to look at the spatial pattern in hospital admissions, shows that the supply of primary care physicians had positive effects on the utilization of SHS. The research questions of those studies are rather different from the problem posed in this study, but they still provide comparable results. Hence, the results from the *coverage of municipal physicians* in this investigation are consistent with those results, and also with the results on the effects in the coverage of nursing homes physicians in Hagen's study (2009:11).

Looking at earlier studies, it is however important to note that these positive effects might not be associated with the *capacity of municipal physicians* in itself (Tjerbo. T,2009:63-64 ; Iversen, T & Kopperud, G.2002:255-256). In an analysis of use of ambulatory care based on reimbursement to outpatient clinics and private specialists, Tjerbo (2009:65) found that higherGP's spare list capacity to some extent reduces the expenditures on specialized health services. Therefore, the availability of access to GP's might be a confounding factor influencing the positive effects found in the results of this study. The measure of utilization of SHS in Tjerbo's analysis is different compared with the one used here, but there is still some correlation with his results and the results of this analysis.. Also in a study made by Hagen (2009:19), the length of stay was reduced with higher coverage of physicians at nursing

homes, and with the provision of more institutions/ nursing homes for elderly of 80 years of age and over. *In sum, the coverage of municipal physicians seems to complement the provision of SHS rather than substituting it.*

In the case of the negative effects provided from the *coverage social nursing care* variable, they are only present in three of the groups: episodic and paroxysmal disorders, Ischemic, ischemic heart diseases, and dorsopathies (see table 13). The effects provided from this explanatory variable had stronger significance (p-value = 0, 01) in episodic and paroxysmal disorders than the effects from the group of ischemic diseases and dorsopathies (p-value= 0, 1). There are possibilities of substitution in the case of these two categories of diagnose-groups, but it is important to acknowledge that the variation in the proportion of hospital inpatient admissions provided from the variation of the estimates of this supply explanatory variable is low. These results possibly complement the findings from a study done by Hagen (2009) as in his results, the effects of *social and nursing care* were not significant in the total utilization of SHS, but the behavior of municipal social and nursing care estimate was in fact negative.

Following the effects from the limited population analyses, the negative significant effects in the dorsopathies group provided from the *coverage of social and nursing care* were prevalent, as in the results for the analysis of the total population of dorsopathies (see table 13). The variation of the hospital inpatient admissions relative to the coverage of social and nursing care estimate is lower if compared with the estimate value in the results for the total dorsopathies population. This shows a conservative possibility of substitution of SHS in reference to this type of provision at the municipal health care level, as the value of its estimate is not sufficiently strong. These effects are open to further considerations and investigations.

Returning to the effects from the total diagnose-groups analyses, the behavior of the explanatory variable of *total residents* was positive but with low significance in the ischemic heart diseases group (see table 13). From this finding, one might infer that there is no substitution between municipality and somatic health care provision in terms of coverage of municipal institutions and nursing homes. However, the behavior in the other results was negative even if they were not significant. Similar findings are present in the results from Hagen (2009:19) regarding this supply explanatory variable. It is plausible that the positive effect from *total residents* captured the variations in needs at “social and nursing institutions

and at nursing homes" being a more common phenomenon in the total analysis diagnose-groups (Hagen, T.2009:19). The behavior of the "*recipients"* variable, that is the effects, also varied across the analyses of the different diagnose-groups. The effects were not significant, but the positive insignificant effects may mirror the same phenomenon as the positive significant effect in *total residents*. An explanation for the statistical insignificance on the *recipients*- and *total residents*- negative effects in the rest of the diagnose-groups is that these groups probably need a lot of care, but not necessarily enormous care at hospitals (Hagen, T.2009:12). Nevertheless, negative effects (with low significance) are evident for the influenza and pneumonia group in the age limited analysis of diagnose-groups. From the discussion of these results, it is not feasible to present strong inferences of substitution in the case of municipal coverage of institutions and nursing homes with respect to the use of SHS, as negative effects were only present in the limited age diagnose-group analysis within one diagnose-group.

When analyzing the use of SHS, it is more likely that *total residents* and *recipients* (supply side variables) provoke more significant variation of utilization in length of stay units than inpatient hospital admissions. The municipal institutional and nursing homes coverage could to an extent the length of stay at hospitals if the coverage is increased. The effect is stronger for patients with needs for institutional places after hospital outpatient admissions (Holmås, T et al. 2007:3). Again, this seems to complement (not substitute) the provision of somatic health care except for the case of re-admissions to hospitals. For instance, home based rehabilitation might reduce the amount of re-admissions, as this evidence is present in patients with brain stroke (Hviding, K et.al.2004:49-50). However, this is outside of the scope of this study

These results did not show significant effects in the coverage of institutions and nursing homes in the utilization of SHS in the age group of 80 years of age and over related to the diagnose-groups used in this investigation. Following Carlsen (unpublished), which includes a more specific analysis on immediate hospital inpatient admissions and on elective inpatient admissions, there are negative effects on both types of inpatient admission on age groups patients of 80 years of age and over when the coverage of municipal institutions increases. This study includes the total proportion of hospital inpatient admission, and it is plausible that this counteracts this effect. For instance, the municipality supply side can do little to avoid surgical inpatient admissions (Hagen, T.2009:20). However, the negative effects (not

significant) in *total residents* and *recipients* in the limited analyses probably mirror the effects found in Carlsen's investigation.

Moving to the significant effects of travel distance in both the analyses of the total diagnose-groups population and the limited age group diagnose-group population, those effects were negative reflecting the expected assumption (see table 13). These effects showed that longer distances indeed reduce the utilization of SHS. That is, the variation of the proportion of hospital inpatient admissions is reduced when the distance to the nearest hospital increases. Similar findings in earlier studies confirm this. For instance, Hagen (2009:19) and Holmas et.al. (2007:7-11) encountered the same significant negative effects in their studies. Patients and their relatives might prefer to be treated within the options that primary health care gives them in the municipalities. This can be a possible explanation of this phenomenon (Holmas et al.2007).

Moreover, this study ran an extended analysis in the ischemic heart diseases population adding explanatory variables of supply such as Hallingdal GP hospital and *sykestuer* (GP hospitals) as this group represents the highest amount of hospital inpatient admissions (see table 13). The GP hospitals called *sykestuer*, gave strong negative values and high significance. This GP hospital explanatory variable can be a better prospect of substitution for the supply of SHS than institutions and nursing homes within municipality social and nursing care services. Those GP hospitals served as pre-hospital buffers with the aim to avoid unnecessary inpatient admissions to general hospitals with patients that are in an acute health state through short-term observation stays (Aaras, I.1995:250). An earlier study of GP's motives for referring patients to general hospitals looked at the impact of GP's decisions on whether to refer to specialist care in a general hospitals, or to treat at GP hospitals (Aaras, I et. al.1998:252-253). The findings from this investigation reflects the negative effects in this study as they found that a lower proportion of patients were referred to general hospitals (Aaras, I et. al.1998:252-253). In chapter 5.6, it was described briefly how the GP hospitals operate and who the owners are. They seem to function as intermediate institutions between general hospitals and primary health care services (municipal health services). Traditionally, they belonged to the somatic health care level, but in later years there has been a reorganization of these GP's hospitals. They are increasingly becoming District Medical Centers that may be part of the primary health services. Providing inferences of substitution from the coverage of specialist health services at general hospitals is not appropriate. However, if they become a part of the provision of primary health services at the

municipalities they can be a potential substitute of general hospitals for those municipalities where the distance from patient's residence to the general hospitals is long.

The analyses also include significant effects on the coverage of private hospitals in the variation of the proportion of hospital inpatient admissions. Negative effects are present in diabetes mellitus and dorsopathies groups in the utilization of SHS. The provision of private health services can be another alternative of substitution of health services from the Somatic health services at public hospitals, but this is outside of the scope of the research problem in this investigation.

The different operationalizations in each of the analyses give evidence that: the coverage of municipal physicians does not reduce the utilization of specialized health (SHS) services, but rather complements it. The findings related to the effects of municipal physicians were consistent with earlier studies, and therefore it is possible to make conclusions with respect to this type of municipal health care supply. Second, the coverage of social and nursing health services reduces the utilization of SHS in some diagnose-groups, but it does not represent an important substitute for somatic health services. Third, the coverage of institutions and nursing homes do not substitute the use of SHS in terms of the total diagnose-groups population, but it might reduce the use of SHS in a very low range for those patients with 80 years and over within the diagnose-groups population chosen based on these findings and other earlier studies. Next follows a brief section on the limitations of these research findings.

7.3 Limitations

Although the study includes a comprehensive range of data from 1999 to 2007, and includes a size sample big enough to avoid problems of ecological fallacy, the results need to be interpreted with a certain degree of reservations. The biggest restriction is related to the level of aggregation of the data since the preferable method is to do it at the individual level. The empirical model took care of possible errors when using aggregation through the use of fixed effects. However, fixed effects might limit the scope of inferences. Therefore, the use of random intercepts to test the impact on utilization of specialized health services between municipalities and hospitals can improve the model.

In addition, significant explanatory variables excluded from the analysis can be a constraint in this study. More specific explanatory variables might better explain the variation in the studied variable, hospital inpatient admissions such as nursing homes physicians and

specialized nursing care. The study searched for explanatory variables that can be good candidates for the analyses, but the availability of data was a present constraint. For instance, lack of data supply factors in terms of social and nursing care provision was a problem given the period chosen for the study. The results in the limited analysis of the populations for the 80 years age and over have some constraints related to the use of supply explanatory variables such as physicians, social and nursing care, and recipients. This is because the data was not available for the type of research used in this analysis. Besides, the study wanted to disaggregate the explanatory variables of needs to better reflect the needs of the 80 years of age and over population, but time was a constraint in this study.

This study could also use a more specific measure for the studied population such as immediate inpatient admissions and/or elective admissions instead of using the total inpatient admissions to hospitals to explore how the provision of municipal health services influence the demand at hospitals. The use of those other measures could provide more specific information related to the utilization of specialized health services. Again, this research project was subjected to time constraints, and therefore total hospital inpatient admissions was used.

Other limitations apply to the diagnose-groups chosen in this investigation because it was difficult to address exactly which diagnose-groups might really receive benefits with an expansion and relocation of health services at the municipalities. Nevertheless, some of them such as diabetes, ischemic heart diseases, problem in the joint and muscle problems such as dorsopathies, are still relevant in terms of the challenges the coordination reform wants to address.

According to the statistical method of regression, the R-square values were lower in the limited analysis. In addition, the residuals distribution of the diagnose-groups limited to the 80 years of age and over group was skewed. The use of WLS method enhanced the R-values in the limited analyses, but a logarithmic transformation of the studied population variables and the explanatory variables of the studied populations, could be another statistical alternative in this case.

8 CONCLUSIONS

Summarizing, the analysis shows that the coverage of municipal physicians in fact increases the use of specialized health services and it might rather complement the provision of specialized health services. As such, the effects from the analyses provide evidence that there is not a strong possibility of substitution between somatic health services and primary health services. The coverage of social and nursing health services served as weak substitute of specialized health services for some specific diagnose-groups. The coverage of institutions and nursing homes for populations of 80 years of age and over can probably reduce, in a very limited range, the use of specialized health services at hospitals as these effects were present in other studies. However, the possibility of substitution with the provision of the latter type of municipal supply is still uncertain, as the effects were not found to be significant in this study. GP hospitals (sykestuer) seemed to be alternative substitutes of utilization of general hospitals, but they do not belong to primary health care services today.

Using for instance a municipal copayment limited to specific diagnose groups such as the ones used in this analysis, may produce a waste of resources as the provision of municipal health services do not prevent the utilization of specialized health services. This could increase the risk for the municipalities since they currently lack the specialization to provide services. It is indeed possible to assume that the consequence of those effects is a result of patients that may either recur to health services or receive services when they are already in an advanced stage of the disease. Hence, future efforts of early intervention and prevention at the municipal care level might reduce the utilization of specialized health services.

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Appendix

[Appendix I] Pathologies and facts of the diagnose-groups populations chosen for the study

Hormonal Disorders from the Endocrine System: Diabetes Mellitus (E10-E14 : ICD-10)

Diabetes mellitus is produced by lack or insufficiency of insulin in the body due to high glucose levels in the blood. There are two main types of diabetes mellitus, type 1 diabetes and type 2 diabetes. In type 1, more than 90 % of the insulin producing cells of the pancreas is permanently destroyed, and generally has a juvenile onset. In type 2, the pancreas produce insulin, but the body develops resistance to insulin and consequently, there is not sufficient insulin to meet the body's needs. The latter prevalently has an adult-onset (Beers, M et al,2003).

Some of the complications are related to circulatory problems such as heart disease, stroke and swings in blood pressures. Other complications are related to poor kidney function. The treatments available for diabetes includes exercise, diet, education and, for almost all, drugs (Beers, M et al,2003).

The occurrence of diabetes in Norway has increased exponentially during the last 40 years. Data from SSB shows approximately 60,000 outpatient consultations for people with diabetes in 2002. The amount of length of days ("liggedager") per 1000 inhabitants is on average 7,5 % of the inhabitants for diabetes patients in general, but 27,9 % for patients of 80 years of age and over. The treatment for diabetes mainly falls within primary care, but there is a need for treatment across different levels of the health services (Hviding, K et al,2004).

Nervous System Disorders: Episodic and Paroxysmal disorders (G40-G47: ICD-10)

According to the International Statistical Classification of Diseases and Related Health Problems System (ICD-10), this group of disorders includes among others epilepsy and vascular syndromes of the brain in cerebrovascular diseases[17].

Epilepsy

This anomaly is produced by seizure disorders, which involves periodical disturbances of the brain's electrical activity. When the brain functions normally, electrical impulses let the brain communicate with the nerves, muscles, the spinal cord, and within the brain itself. Hence, when periodical disturbances occur, a seizure is possibly the result. In Norway, there are approximately 45,000 persons diagnosed with this disorder according to the Norwegian Association of Epilepsy ("Norsk Epilepsiforbund ",2010). There is a variety of treatments, depending on the degree and severity of the problem. Usually, anticonvulsants (drug) are used to avoid the occurrence of the problem. When drugs are ineffective or patients show intolerance to the drugs, a brain surgery is an option. For this reason, the disorder needs to be treated and followed up between somatic and primary levels of care (Habberstad, A.2008; Hviding, K et al,2004).

Vascular syndromes of br cerebrovascular diseases

There are two major diseases related to this subgroup - hemorrhagic stroke and ischemic stroke. These are the most common causes of disabling neurologic damage in Western countries. Hemorrhagic stroke affects the brain (cerebral) and the blood vessels (vascular). The stroke is hemorrhagic as it involves bleeding around the brain. Blood vessels rupture, impeding the normal blood flow and consequently, blood leaks into the brain tissue. The leak irritates the tissue and may cause scarring, leading to seizures. The ischemic stroke occurs due to a blocked artery. When the artery is blocked, blood cells do not receive oxygen and glucose (Beers, M et al, 2003).

Some of the measures to prevent it include managing the major risk factors, such as high blood pressure. After a hemorrhagic stroke has occurred, intensive rehabilitation is necessary

[17] The ICD-10 List related to the diagnose-groups used in this study is plac

after a surgery. This could be provided at home or in a rehabilitation center (Beers, M et al,2003).

Circulatory System disorders: ischemic heart diseases (I20-I25: ICD-10)

These diseases are part of the group of coronary artery diseases. This condition takes place because the blood supply to the heart muscle is blocked, partially or completely. Two main diseases pertain to these groups of diseases - angina pectoris and heart attack. Angina pectoris provokes temporary chest pain when the heart muscle is not receiving sufficient amounts of oxygen. The treatments of this disorder include drug therapy, coronary angioplasty and coronary artery bypass surgery. On the other hand, heart attack is a medical emergency caused by the heart's blood supply being reduced or cut off, causing the heart muscle to die because of the lack of oxygen (Beers, M et al,2003).

In 2008, it was documented 5,636 deaths due to this disease (SSB 2010). In 2002, 4600 patients of 80 years of age and over were hospitalized at Norwegian hospitals owing to heart attack. Heart attacks accounts for the third most common cause of deaths in Norway. The number of bed days for patients suffering angina pectoris or heart failure amounted to 96.688 in 2007. Management of risk factors may help to prevent coronary artery diseases. Some of them are a healthy diet, quitting smoking, and managing cholesterol and blood pressure levels. Rehabilitation is primordial for the recovery after the disorders have occurred and hospital treatment is carried out (Beers, M et al,2003; Hviding, K et al,2004)

Respiratory system disorders: influenza and pneumonia (J10-J18: ICD-10)

Influenza is an acute viral infection that affects different parts of the respiratory system. Generally, it lasts for about a week, and its symptoms comprehend a sudden onset of high fever, aching muscles, headache, non-productive cough, sore throat and rhinitis. Many infected people do not require medical treatment or hospitalization. However, the elderly, children, and those with serious medical conditions are more exposed to severe complications. This is often related to an underlying condition such as pneumonia, an may lead to death (WHO,2009b).

Pneumonia is an infection located in the small air of the lungs and the tissues that surrounds them. According to SSB (2008), 1656 deaths were attributed to this illness in 2008. The most usual symptom is a cough that produces sputum, but there are other complications such as shortness of breath and chest pain. Vaccination is the most common preventive means to

protect against pneumococcal (bacterial) pneumonia and pneumonia caused by influenza. The normal treatment for this infection is antibiotic medication including, when severe, hospitalization (Beers, M et al,2003).

Bone, joint and muscle disorders: dorsopathies (M40-M54: ICD-10)

Dosropathies means back pain disorders. It involves low back pain such as lumbago and upper back pain such as brachial neuritis. Other disorders include ankylosing spondylitis and scoliosis (Beers, M et al,2003).

[**Appendix II**] Table International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Version for 2007, source: adapted from WHO (2010)

Diabetes mellitus (E10-E14)	
E10	Insulin-dependent diabetes mellitus
E11	Non-insulin-dependent diabetes mellitus
E12	Malnutrition-related diabetes mellitus
E13	Other specified diabetes mellitus
E14	Unspecified diabetes mellitus
Episodic and paroxysmal disorders (G40-G47)	
G40	Epilepsy
G41	Status epilepticus
G43	Migraine
G44	Other headache syndromes
G45	Transient cerebral ischemic attacks and related syndromes
G46*	Vascular syndromes of brain in cerebrovascular diseases (I60-I67+)
G47	Sleep disorders
Ischemic heart diseases (I20-I25)	
	Includes: with mention of hypertension (I10-I15)
I20	Angina pectoris
I21	Acute myocardial infarction
I22	Subsequent myocardial infarction
I23	Certain current complications following acute myocardial infarction
I24	Other acute ischaemic heart diseases
I25	Chronic ischaemic heart disease
Influenza and pneumonia (J09-J18)	
J09	Influenza due to identified avian influenza virus
J10	Influenza due to other identified influenza virus
J11	Influenza, virus not identified
J12	Viral pneumonia, not elsewhere classified
J13	Pneumonia due to Streptococcus pneumoniae
J14	Pneumonia due to Haemophilus influenzae
J15	Bacterial pneumonia, not elsewhere classified
J16	Pneumonia due to other infectious organisms, not elsewhere classified
Influenza and pneumonia (J09-J18)	
J17*	Pneumonia in diseases classified elsewhere

J18	Pneumonia, organism unspecified

Dorsopathies

(M40-M54)

Deforming dorsopathies
(M40-M43)

M40	Kyphosis and lordosis
M41	Scoliosis
M42	Spinal osteochondrosis
M43	Other deforming dorsopathies

Spondylopathies
(M45-M49)

M45	Ankylosing spondylitis
M46	Other inflammatory spondylopathies
M47	Spondylosis
M48	Other spondylopathies
M49*	Spondylopathies in diseases classified elsewhere

Other dorsopathies
(M50-M54)

M50	Cervical disc disorders
M51	Other intervertebral disc disorders
M53	Other dorsopathies, not elsewhere classified
M54	Dorsalgia

[**Appendix III**] Table of Municipalities excluded from the analysis

Municipalities excluded from the analysis
1154: Vindafjord; 1160: Vindafjord
1159: Ølen
1505: Kristiansund
1569: Aure ; 1576: Aure
1572: Tustna
1842: Skjerstad
0816: Kragerø

[**Appendix IV**] Table of HA numbers

Number of HA	Hospital Authority/ catchment area (HANR)	Description/ County distribution
1	Sykehuset Østfold HA	
2	Akershus Universitetssykehus HA	
3	Oslo*	
4	Sykehuset Innlandet HA	Hedmark and Oppland
5	Sykehuset Asker og Bærum HA	Asker og Bærum
6	Ringerike Sykehus HA	Buskerud
7	Sykehuset Buskerud HA	
8	Blefjell Sykehus HA	Buskerud
9	Sykehuset i Vestfold HA	
10	Sykehuset Telemark HA	
11	Sørlandet Sykehus HA	Telemark, Aust-Agder, Vest Agder
12	Stavanger Universitetssykehus HA	Vest-Agder, Rogaland
13	Helse Fonna HA	Rogaland
14	Helse Bergen HA	Hordaland
15	Helse Førde HA	Sogn og Fjordane
16	Helse Sunnmøre HA	Møre og Romsdal
17	Helse Nordmøre og Romsdal HA	Møre og Romsdal
18	St. Olavs Hospital HA	Møre og Romsdal, Sør-Trøndelag
19	Helse Nord-Trøndelag HA	
20	Helgelandssykehuset HA	Nordland
21	Nordlandssykehuset HA	
22	Hålogalandssykehuset HA	Nordland
23	Universitetssykehuset Nord-Norge HA	Troms
24	Helse Finnmark HA	

* HANR3 includes Rikshospitalet HA, Ullevål Universitetssykehus HA and AHUS Universitetssykehus HA due to a subdivision of Oslo in districts. Data on the home district of the patients from Oslo municipality is not available.

[**Appendix V**] List of private Hospitals

Private Hospitals	Location
Aleris	Oslo, Bergen, Trondheim, Kristiandsand and Romerike
Drammen Private Sykehus	Drammen
Feiringklinikken	Akerhus County
Glittreklinikken	Nyttedal Municipality
Hjertesenteret i Oslo	Oslo
Medi 3 Molde	Molde
Medi 3 Ålesund	Ålesund
Sykehus og spesialistklinikk	Oslo
Volvat medisinske senter	Vestre Aker

[Appendix VI] Results of the limited utilization analysis of diagnose groups

[Appendix VI-1] Results: Diabetes Mellitus

Models for Diabetes mellitus: **Variables**	**I** β/ Std E.	**II** β/ Std E.	**III** β/ Std E.
(Constant)	**8,005** (1,736)***	**8,357** (1,781)***	**7,981** (1,762)***
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**-0,384** (0,320)	**-0,221** (0,324)	**-0,304** (0,321)
Social Nursing Care Man-years	**-0,004** (0,013)	-	-
Total Residents	-	**-0,000** (0,001)	-
Recipients (Nursing homes and Institutions)	-	-	**0,000** (0,001)
Explanatory variables of needs:			
Mortality	**0,033** (0,046)	**0,017** (0,047)	**0,023** (0,046)
Population, 80+	**0,008** (0,010)	**0,008** (0,010)	**0,011** (0,010)
Gross Income	**-0,035** (0,036)	**-0,051** (0,037)	**-0,036** (0,036)
Low education	**0,000** (0,002)	**0,000** (0,002)	**0,000** (0,002)
Immigration	**0,008** (0,006)	**0,007** (0,006)	**0,007** (0,006)
Summer Temperature	**-0,230** (0,083)***	**-0,221** (0,084)***	**-0,225** (0,084)***
Explanatory variables of supply variation:			
Travel Distance	**-0,006** (0,002)***	**-0,007** (0,002)***	**-0,008** (0,002)***
Fixed effects (HA)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,143** (0,299)	**-0,039** (0,301)	**-0,066** (0,302)
Fixed effects (year)	Yes	Yes	Yes
R square	**0,066**	**0,067**	**0,068**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

[Appendix VI-2] Results**:** Episodic and paroxysmal disorders

Models for episodic and paroxismal disorders: **Variables**	**I** β/ Std E.	**II** β/ Std E.	**III** β/ Std E.
(Constant)	**10,459** (2,399)***	**10,262** (2,503)***	**10,165** (2,534)***
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**-0,242** (0,442)	**-0,314** (0,456)	**-0,493** (0,458)
Social Nursing Care Man-years	**-0,007** (0,019)	-	-
Total Residents	-	**-0,000** (0,002)	-
Recipients (Nursing homes and Institutions)			**-0,006** (0,012)
Explanatory variables of needs:			
Mortality	**-0,197** (0,064)***	**-0,158** (0,066)**	**-0,155** (0,066)**
Population, 80+	**0,015** (0,014)	**0,013** (0,014)	**0,016** (0,016)
Gross Income	**-0,017** (0,050)	**-0,021** (0,052)	**-0,020** (0,051)
Low education	**-0,003** (0,003)	**-0,003** (0,003)	**-0,003** (0,003)
Immigration	**0,007** (0,008)	**0,010** (0,009)	**0,011** (0,009)
Summer Temperature	**-0,151** (0,114)	**-0,142** (0,118)	**-0,133** (0,120)
Explanatory variables of supply variation:			
Travel Distance	**-0,017** (0,003)***	**-0,019** (0,003)***	**-0,015** (0,003)***
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,095** (0,413)	**-0,131** (0,423)	**-0,116** (0,429)
Fixed effects (year)	Yes	Yes	Yes
R square	**0,067**	**0,071**	**0,067**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

[Appendix VI-3] Results: Ischemic heart diseases

Models for Ischemic heart diseases: Variables	**I** β/ Std E.	**II** β/ Std E.	**III** β/ Std E.
(Constant)	**74,923** (8,322)***	**82,020** (8,661)***	**76,388** (8,784)***
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**3,538** (1,532)**	**3,880** (1,578)**	**4,553** (1,588)***
Social Nursing Care Man-years	**-0,062** (0,064)	-	-
Total Residents	-	**-0,006** (0,005)	-
Recipients (Nursing homes and Institutions)			**-0,055** (0,042)
Explanatory variables of needs:			
Mortality	**0,369** (0,221)*	**0,254** (0,229)	**0,401** (0,230)*
Population, 80+	**-0,197** (0,050)***	**-0,215** (0,049)***	**-0,187** (0,057)***
Gross Income	**-0,348** (0,172)**	**-0,419** (0,179)**	**-0,386** (0,176)**
Low education	**0,025** (0,010)**	**0,021** (0,011)*	**0,023** (0,011)**
Immigration	**0,102** (0,029)***	**0,090** (0,030)***	**0,095** (0,030)***
Summer Temperature	**-1,650** (0,396)***	**-1,834** (0,409)***	**-1,704** (0,418)***
Explanatory variables of supply variation:			
Travel Distance	**-0,113** (0,011)***	**-0,122** (0,011)***	**-0,123** (0,011)***
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**0,211** (1,433)	**-0,108** (1,465)	**-0,121** (1,488)
Fixed effects (year)	Yes	Yes	Yes
R square	**0,147**	**0,153**	**0,150**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

[Appendix VI-4] Results: Dorsopathies

Models for Dorsopathies: Variables	**I** β/ Std E.	**II** β/ Std E.	**III** β/ Std E.
(Constant)	**3,510** (1,514)****	**3,372** (1,580)****	**3,521** (1,605)****
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**0,379** (0,279)	**3,880** (1,578)**	**0,317** (0,290)
Social Nursing Care Man-years	**-0,028** (0,012)**	-	-
Total Residents	-	**-0,001** (0,001)	-
Recipients (Nursing homes and Institutions)			**-0,003** (0,008)
Explanatory variables of needs:			
Mortality	**-0,004** (0,040)	**0,001** (0,042)	**-0,018** (0,042)
Population, 80+	**0,012** (0,009)	**0,008** (0,009)	**0,013** (0,057)
Gross Income	**-0,010** (0,031)	**-0,014** (0,033)	**-0,003** (0,032)
Low education	**-0,002** (0,002)	**-0,003** (0,002)	**-0,003** (0,002)
Immigration	**0,015** (0,005)***	**0,013** (0,005)**	**0,013** (0,006)**
Summer Temperature	**-0,075** (0,072)	**-0,057** (0,075)	**-0,078** (0,076)
Explanatory variables of supply variation:			
Travel Distance	**-0,011** (0,002)****	**-0,012** (0,002)****	**-0,012** (0,002)****
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,193** (0,261)	**-0,254** (0,267)	**-0,219** (0,406)
Fixed effects (year)	Yes	Yes	Yes
R square	**0,080**	**0,085**	**0,078**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

[Appendix VI-5] Results: Influenza and pneumonia

Models for Influenza and pneumonia: Variables	**I** β/ Std E.	**II** β/ Std E.	**III** β/ Std E.
(Constant)	**56,057** (6,111))***	**59,107** (6,386)***	**62,799** (6,487)***
Explanatory variables of supply or equivalent factors of it			
Physicians Man-years	**-0,310** (1,125)	**-1,015** (1,164)	**-0,439** (1,173)
Social Nursing Care Man-years	**-0,075** (0,047)	-	-
Total Residents	-	**-0,001** (0,004)	-
Recipients (Nursing homes and Institutions)			**-0,060** (0,031)*
Explanatory variables of needs:			
Mortality	**0,753** (0,162)***	**0,711** (0,169)***	**0,804** (0,170)***
Population, 80+	**-0,132** (0,037)***	**-0,144** (0,036)***	**-0,115** (0,042)***
Gross Income	**-0,216** (0,126)*	**-0,205** (0,008)	**-0,251** (0,130)*
Low Education	**-0,017** (0,007)**	**-0,015** (0,008)*	**-0,017** (0,008)**
Immigration	**0,004** (0,022)	**0,008** (0,022)	**0,005** (0,022)
Summer Temperature	**-1,081** (0,291)***	**-1,337** (0,301)***	**-1,369** (0,308)***
Explanatory variables of supply variation:			
Travel Distance	**-0,099** (0,008)***	**-0,104** (0,008)***	**-0,102** (0,008)***
Fixed effects (HF)	Yes	Yes	Yes
Fixed effects (Private hospitals)	**-0,868** (1,052)	**-1,377** (1,080)	**-1,352** (1,099)
Fixed effects (year)	Yes	Yes	Yes
R square	**0,223**	**0,232**	**0,223**

***p= < 0, 01 **p= < 0, 05 *p=< 0, 1 **β: beta coefficient**

[Apprendix VII]Results: Fixed effects for the total population analysis

Diabetes									
Fixed	Model I			Model II			Model III		
Effects	B	std. Error	sig	B	std. Error	sig	B	std. Error	sig.
HA 1	-0,52	0,07	0,000	-0,52	0,08	0,000	-0,52	0,08	0,000
HA 3	-0,26	0,10	0,031	-0,26	0,12	0,025	-0,26	0,12	0,031
HA 4	-0,33	0,07	0,000	-0,33	0,08	0,000	-0,33	0,08	0,000
HA 5	0,12	0,10	0,239	0,13	0,11	0,232	0,12	0,10	0,239
HA 6	0,06	0,05	0,619	0,07	0,12	0,586	0,06	0,12	0,619
HA 7	0,11	0,05	0,204	0,11	0,09	0,212	0,11	0,09	0,204
HA 8	0,41	0,11	0,000	0,40	0,09	0,000	0,41	0,09	0,000
HA 9	-0,17	0,06	0,038	-0,17	0,08	0,046	-0,17	0,08	0,038
HA 10	0,29	0,07	0,003	0,28	0,10	0,005	0,29	0,10	0,003
HA 11	0,16	0,07	0,055	0,16	0,08	0,056	0,16	0,08	0,055
HA 12	0,30	0,07	0,000	0,29	0,08	0,000	0,30	0,07	0,000
HA 13	0,51	0,08	0,000	0,51	0,08	0,000	0,51	0,08	0,000
HA 14	1,18	0,11	0,000	1,18	0,08	0,000	1,18	0,08	0,000
HA 15	0,94	0,08	0,000	0,95	0,10	0,000	0,94	0,10	0,000
HA 16	0,28	0,09	0,005	0,28	0,10	0,004	0,28	0,10	0,005
HA 17	0,32	0,08	0,003	0,32	0,11	0,003	0,32	0,11	0,003
HA 18	-0,09	0,10	0,282	-0,09	0,09	0,311	-0,09	0,09	0,282
HA 19	-0,29	0,08	0,003	-0,29	0,10	0,004	-0,29	0,10	0,003
HA 20	0,65	0,07	0,000	0,65	0,11	0,000	0,65	0,11	0,000
HA 21	-0,11	0,08	0,457	-0,13	0,15	0,374	-0,11	0,15	0,457
HA 22	-0,01	0,08	0,951	-0,01	0,11	0,943	-0,01	0,11	0,951
HA 23	-0,83	0,10	0,000	-0,82	0,17	0,000	-0,83	0,17	0,000
HA 24	-0,12	0,09	0,405	-0,13	0,14	0,360	-0,12	0,14	0,405
Year 2000	-0,11	0,10	0,140	-0,11	0,08	0,145	-0,11	0,08	0,140
year 2001	-0,09	0,09	0,225	-0,09	0,07	0,235	-0,09	0,07	0,225
year 2002	-0,31	0,10	0,011	-0,31	0,12	0,012	-0,31	0,12	0,011
year 2003	-0,10	0,11	0,228	-0,10	0,08	0,241	-0,10	0,08	0,228
year 2004	0,03	0,14	0,723	0,03	0,09	0,710	0,03	0,09	0,723
year 2005	0,01	0,11	0,908	0,01	0,10	0,898	0,01	0,10	0,908
year 2006	0,10	0,15	0,280	0,10	0,09	0,276	0,10	0,09	0,280
year 2007	-0,02	0,13	0,858	-0,02	0,10	0,840	-0,02	0,10	0,858

Episodic and paroxismal disorders									
Fixed Effects	Model I			Model II			Model III		
	B	std. Error	sig	B	Std. Error	sig	B	Std. Error	sig.
HA 1	-1,56	0,17	0,000	-1,64	0,18	0,000	-1,68	0,18	0,000
HA 3	-0,07	0,34	0,826	-0,24	0,36	0,507	-0,26	0,36	0,471
HA 4	-1,33	0,16	0,000	-1,38	0,18	0,000	-1,41	0,17	0,000
HA 5	-0,51	0,28	0,070	-0,64	0,30	0,031	-0,63	0,30	0,035
HA 6	-1,55	0,24	0,000	-1,59	0,26	0,000	-1,62	0,26	0,000
HA 7	-1,52	0,21	0,000	-1,62	0,22	0,000	-1,67	0,22	0,000
HA 8	-2,24	0,20	0,000	-2,36	0,21	0,000	-2,39	0,21	0,000
HA 9	-2,69	0,19	0,000	-2,83	0,20	0,000	-2,87	0,20	0,000
HA 10	-2,90	0,23	0,000	-3,08	0,24	0,000	-3,10	0,24	0,000
HA 11	-1,53	0,18	0,000	-1,61	0,19	0,000	-1,68	0,19	0,000
HA 12	-2,39	0,17	0,000	-2,59	0,18	0,000	-2,62	0,18	0,000
HA 13	-2,13	0,18	0,000	-2,34	0,19	0,000	-2,36	0,19	0,000
HA 14	-0,31	0,18	0,083	-0,35	0,19	0,060	-0,38	0,19	0,042
HA 15	0,06	0,19	0,764	-0,04	0,20	0,848	-0,09	0,20	0,663
HA 16	-2,24	0,20	0,000	-2,39	0,21	0,000	-2,43	0,21	0,000
HA 17	-2,12	0,20	0,000	-2,24	0,21	0,000	-2,28	0,21	0,000
HA 18	-2,06	0,19	0,000	-2,18	0,20	0,000	-2,24	0,20	0,000
HA 19	-2,20	0,20	0,000	-2,32	0,21	0,000	-2,40	0,21	0,000
HA 20	-0,66	0,22	0,003	-0,62	0,24	0,009	-0,70	0,24	0,003
HA 21	-1,59	0,26	0,000	-1,74	0,28	0,000	-1,79	0,28	0,000
HA 22	-2,28	0,22	0,000	-2,43	0,24	0,000	-2,46	0,24	0,000
HA 23	-3,07	0,28	0,000	-3,22	0,30	0,000	-3,31	0,30	0,000
HA 24	-2,33	0,27	0,000	-2,43	0,28	0,000	-2,51	0,28	0,000
year 2000	0,00	0,14	0,978	0,18	0,19	0,329	0,19	0,19	0,320
year 2001	0,42	0,14	0,003	0,52	0,18	0,003	0,52	0,18	0,003
year 2002	0,76	0,26	0,003	0,84	0,29	0,004	0,83	0,29	0,004
year 2003	2,28	0,16	0,000	2,35	0,19	0,000	2,34	0,19	0,000
year 2004	2,63	0,17	0,000	2,68	0,20	0,000	2,68	0,20	0,000
year 2005	2,93	0,18	0,000	2,99	0,21	0,000	2,99	0,21	0,000
year 2006	2,92	0,18	0,000	2,96	0,21	0,000	2,96	0,21	0,000
year 2007	2,54	0,20	0,000	2,54	0,23	0,000	2,57	0,23	0,000

	Ischemic Heart Diseases								
	Model I			Model II			Model III		
Fixed Effects	B	Std. Error	sig	B	Std. Error	sig	B	Std. Error	sig.
HA 1	-1,62	0,37	0,000	-1,76	0,38	0,000	-1,85	0,38	0,000
HA 3	-2,39	0,72	0,001	-2,36	0,76	0,002	-2,42	0,76	0,002
HA 4	-2,15	0,35	0,000	-2,04	0,37	0,000	-2,13	0,37	0,000
HA 5	-1,87	0,61	0,002	-1,94	0,63	0,002	-2,00	0,63	0,001
HA 6	-2,87	0,52	0,000	-2,91	0,55	0,000	-2,92	0,55	0,000
HA 7	-0,37	0,44	0,408	-0,30	0,47	0,517	-0,32	0,47	0,490
HA 8	-1,73	0,42	0,000	-1,88	0,44	0,000	-1,98	0,44	0,000
HA 9	-2,11	0,40	0,000	-2,25	0,42	0,000	-2,31	0,42	0,000
HA 10	-0,22	0,49	0,657	-0,17	0,51	0,738	-0,34	0,51	0,507
HA 11	-2,44	0,38	0,000	-2,52	0,40	0,000	-2,63	0,40	0,000
HA 12	-3,13	0,36	0,000	-3,30	0,37	0,000	-3,34	0,38	0,000
HA 13	-1,33	0,39	0,001	-1,44	0,41	0,000	-1,48	0,41	0,000
HA 14	-4,03	0,38	0,000	-4,36	0,40	0,000	-4,41	0,40	0,000
HA 15	-1,15	0,41	0,005	-1,40	0,42	0,001	-1,46	0,42	0,001
HA 16	-3,24	0,43	0,000	-3,49	0,45	0,000	-3,51	0,45	0,000
HA 17	-4,18	0,43	0,000	-4,46	0,44	0,000	-4,49	0,45	0,000
HA 18	-3,86	0,40	0,000	-4,14	0,43	0,000	-4,14	0,42	0,000
HA 19	-4,73	0,43	0,000	-5,20	0,45	0,000	-5,20	0,44	0,000
HA 20	-0,07	0,48	0,883	-0,18	0,50	0,713	-0,28	0,50	0,572
HA 21	-0,71	0,56	0,206	-1,05	0,60	0,080	-1,16	0,59	0,048
HA 22	0,59	0,48	0,221	0,07	0,50	0,883	0,01	0,50	0,979
HA 23	-0,88	0,60	0,146	-1,29	0,64	0,043	-1,38	0,63	0,029
HA 24	4,23	0,58	0,000	4,07	0,60	0,000	3,99	0,60	0,000
year 2000	-0,20	0,29	0,487	-0,42	0,40	0,289	-0,41	0,40	0,306
year 2001	1,34	0,30	0,000	1,32	0,37	0,000	1,34	0,37	0,000
year 2002	-0,84	0,56	0,136	-1,15	0,61	0,059	-1,07	0,61	0,079
year 2003	1,69	0,34	0,000	1,57	0,41	0,000	1,60	0,41	0,000
year 2004	1,69	0,36	0,000	1,56	0,42	0,000	1,59	0,42	0,000
year 2005	1,36	0,39	0,001	1,26	0,45	0,005	1,29	0,45	0,004
year 2006	2,27	0,38	0,000	2,16	0,44	0,000	2,17	0,44	0,000
year 2007	2,13	0,43	0,000	2,02	0,48	0,000	2,05	0,48	0,000

Inlfuenza and Pneumonia									
Fixed	Model I			Model II			Model III		
Effects	B	Std. Error	Sig.	B	Std. Error	Sig	B	Std. Error	Sig
HA 1	0,46	0,16	0,00	0,46	0,17	0,01	0,46	0,17	0,01
HA 3	0,47	0,32	0,15	0,50	0,34	0,14	0,54	0,34	0,12
HA 4	-0,16	0,16	0,31	-0,13	0,17	0,43	-0,13	0,17	0,42
HA 5	-0,48	0,27	0,08	-0,50	0,28	0,07	-0,46	0,28	0,10
HA 6	-0,02	0,23	0,93	0,04	0,25	0,86	0,01	0,25	0,97
HA 7	-0,29	0,20	0,14	-0,28	0,21	0,18	-0,28	0,21	0,18
HA 8	-1,13	0,19	0,00	-1,22	0,20	0,00	-1,20	0,20	0,00
HA 9	-0,58	0,18	0,00	-0,62	0,19	0,00	-0,62	0,19	0,00
HA 10	-1,84	0,22	0,00	-1,88	0,23	0,00	-1,83	0,23	0,00
HA 11	-0,24	0,17	0,16	-0,21	0,18	0,24	-0,19	0,18	0,29
HA 12	0,77	0,16	0,00	0,76	0,17	0,00	0,78	0,17	0,00
HA 13	1,02	0,18	0,00	0,97	0,18	0,00	0,98	0,18	0,00
HA 14	0,84	0,17	0,00	0,75	0,18	0,00	0,76	0,18	0,00
HA 15	1,20	0,18	0,00	1,18	0,19	0,00	1,16	0,19	0,00
HA 16	0,72	0,19	0,00	0,73	0,20	0,00	0,72	0,20	0,00
HA 17	0,22	0,19	0,25	0,19	0,20	0,35	0,18	0,20	0,36
HA 18	-0,56	0,18	0,00	-0,63	0,19	0,00	-0,65	0,19	0,00
HA 19	-0,52	0,19	0,01	-0,54	0,20	0,01	-0,55	0,20	0,01
HA 20	-0,22	0,21	0,30	-0,29	0,22	0,19	-0,30	0,22	0,18
HA 21	-1,15	0,25	0,00	-1,21	0,27	0,00	-1,26	0,26	0,00
HA 22	-0,61	0,21	0,00	-0,68	0,22	0,00	-0,66	0,22	0,00
HA 23	-1,01	0,27	0,00	-0,93	0,28	0,00	-0,98	0,28	0,00
HA 24	-0,71	0,26	0,01	-0,75	0,27	0,01	-0,73	0,27	0,01
year 2000	0,19	0,13	0,15	0,09	0,18	0,60	0,10	0,18	0,59
year 2001	0,13	0,13	0,35	0,06	0,17	0,73	0,07	0,17	0,69
year 2002	0,15	0,25	0,54	0,08	0,27	0,77	0,15	0,27	0,57
year 2003	0,78	0,15	0,00	0,71	0,18	0,00	0,74	0,18	0,00
year 2004	0,61	0,16	0,00	0,53	0,19	0,00	0,57	0,19	0,00
year 2005	1,67	0,17	0,00	1,59	0,20	0,00	1,63	0,20	0,00
year 2006	1,62	0,17	0,00	1,54	0,20	0,00	1,59	0,20	0,00
year 2007	1,94	0,19	0,00	1,82	0,22	0,00	1,90	0,22	0,00

[Apprendix VIII]Results: Fixed effects for the limited population analysis

Fixed Effects	Diabetes								
	Model I			Model II			Model III		
	B	Std. Error	sig	B	Std. Error	sig	B	Std. Error	sig.
HA 1	-0,52	.450	0,00	-0,52	.447	0,00	-0,52	.455	0,00
HA 3	-0,26	.921	0,03	-0,26	.893	0,03	-0,26	.921	0,03
HA 4	-0,33	.429	0,00	-0,33	.425	0,00	-0,33	.429	0,00
HA 5	0,12	.766	0,24	0,13	.756	0,23	0,12	.763	0,24
HA 6	0,06	.670	0,62	0,07	.654	0,59	0,06	.672	0,62
HA 7	0,11	.562	0,20	0,11	.556	0,21	0,11	.567	0,20
HA 8	0,41	.524	0,00	0,40	.522	0,00	0,41	.525	0,00
HA 9	-0,17	.487	0,04	-0,17	.481	0,05	-0,17	.488	0,04
HA 10	0,29	.604	0,00	0,28	.597	0,01	0,29	.606	0,00
HA 11	0,16	.434	0,05	0,16	.430	0,06	0,16	.431	0,05
HA 12	0,30	.447	0,00	0,29	.447	0,00	0,30	.448	0,00
HA 13	0,51	.491	0,00	0,51	.487	0,00	0,51	.493	0,00
HA 14	1,18	.476	0,00	1,18	.467	0,00	1,18	.475	0,00
HA 15	0,94	.513	0,00	0,95	.510	0,00	0,94	.508	0,00
HA 16	0,28	.538	0,00	0,28	.530	0,00	0,28	.539	0,00
HA 17	0,32	.539	0,00	0,32	.537	0,00	0,32	.536	0,00
HA 18	-0,09	.502	0,28	-0,09	.493	0,31	-0,09	.499	0,28
HA 19	-0,29	.520	0,00	-0,29	.516	0,00	-0,29	.517	0,00
HA 20	0,65	.584	0,00	0,65	.574	0,00	0,65	.581	0,00
HA 21	-0,11	.711	0,46	-0,13	.682	0,37	-0,11	.703	0,46
HA 22	-0,01	.559	0,95	-0,01	.556	0,94	-0,01	.555	0,95
HA 23	-0,83	.749	0,00	-0,82	.711	0,00	-0,83	.728	0,00
HA 24	-0,12	.659	0,40	-0,13	.656	0,36	-0,12	.653	0,40
year 2000	-0,11	.436	0,14	-0,11	.368	0,14	-0,11	.422	0,14
year 2001	-0,09	.500	0,22	-0,09	.376	0,24	-0,09	.498	0,22
year 2002	-0,31	.417	0,01	-0,31	.393	0,01	-0,31	.400	0,01
year 2003	-0,10	.429	0,23	-0,10	.409	0,24	-0,10	.410	0,23
year 2004	0,03	.444	0,72	0,03	.425	0,71	0,03	.424	0,72
year 2005	0,01	.490	0,91	0,01	.467	0,90	0,01	.467	0,91
year 2006	0,10	.481	0,28	0,10	.460	0,28	0,10	.457	0,28
year 2007	-0,02	.533	0,86	-0,02	.515	0,84	-0,02	.511	0,86

Fixed Effects	Episodic and paroxysmal disorder								
	Model I			Model II			Model III		
	B	Std. Error	sig	B	Std. Error	sig	B	Std. Error	sig.
HA 1	-1,56	.618	0,00	-1,64	.632	0,00	-1,68	.641	0,00
HA 3	-0,07	1.234	0,83	-0,24	1.294	0,51	-0,26	1.306	0,47
HA 4	-1,33	.587	0,00	-1,38	.603	0,00	-1,41	.611	0,00
HA 5	-0,51	1.044	0,07	-0,64	1.077	0,03	-0,63	1.082	0,03
HA 6	-1,55	.904	0,00	-1,59	.942	0,00	-1,62	.954	0,00
HA 7	-1,52	.769	0,00	-1,62	.791	0,00	-1,67	.807	0,00
HA 8	-2,24	.721	0,00	-2,36	.737	0,00	-2,39	.751	0,00
HA 9	-2,69	.665	0,00	-2,83	.684	0,00	-2,87	.690	0,00
HA 10	-2,90	.825	0,00	-3,08	.850	0,00	-3,10	.855	0,00
HA 11	-1,53	.594	0,00	-1,61	.611	0,00	-1,68	.629	0,00
HA 12	-2,39	.618	0,00	-2,59	.628	0,00	-2,62	.642	0,00
HA 13	-2,13	.673	0,00	-2,34	.690	0,00	-2,36	.700	0,00
HA 14	-0,31	.645	0,08	-0,35	.670	0,06	-0,38	.678	0,04
HA 15	0,06	.705	0,76	-0,04	.721	0,85	-0,09	.724	0,66
HA 16	-2,24	.733	0,00	-2,39	.756	0,00	-2,43	.770	0,00
HA 17	-2,12	.743	0,00	-2,24	.757	0,00	-2,28	.768	0,00
HA 18	-2,06	.681	0,00	-2,18	.706	0,00	-2,24	.713	0,00
HA 19	-2,20	.714	0,00	-2,32	.732	0,00	-2,40	.744	0,00
HA 20	-0,66	.793	0,00	-0,62	.821	0,01	-0,70	.826	0,00
HA 21	-1,59	.943	0,00	-1,74	.999	0,00	-1,79	.994	0,00
HA 22	-2,28	.768	0,00	-2,43	.786	0,00	-2,46	.798	0,00
HA 23	-3,07	.983	0,00	-3,22	1.053	0,00	-3,31	1.032	0,00
HA 24	-2,33	.907	0,00	-2,43	.926	0,00	-2,51	.941	0,00
year 2000	0,00	.509	0,98	0,18	.612	0,33	0,19	.690	0,32
year 2001	0,42	.519	0,00	0,52	.702	0,00	0,52	.644	0,00
year 2002	0,76	.544	0,00	0,84	.586	0,00	0,83	.664	0,00
year 2003	2,28	.565	0,00	2,35	.603	0,00	2,34	.679	0,00
year 2004	2,63	.587	0,00	2,68	.624	0,00	2,68	.696	0,00
year 2005	2,93	.646	0,00	2,99	.689	0,00	2,99	.749	0,00
year 2006	2,92	.636	0,00	2,96	.676	0,00	2,96	.737	0,00
year 2007	2,54	.711	0,00	2,54	.750	0,00	2,57	.804	0,00

Fixed Effects	Ischemic Heart Diseases								
	Model I			Model II			Model III		
	B	Std. Error	sig	B	Std. Error	sig	B	Std. Error	sig.
HA 1	-1,62	2.142	0,00	-1,76	2.187	0,00	-1,85	2.223	0,00
HA 3	-2,39	4.281	0,00	-2,36	4.479	0,00	-2,42	4.529	0,00
HA 4	-2,15	2.036	0,00	-2,04	2.086	0,00	-2,13	2.119	0,00
HA 5	-1,87	3.622	0,00	-1,94	3.728	0,00	-2,00	3.750	0,00
HA 6	-2,87	3.136	0,00	-2,91	3.259	0,00	-2,92	3.307	0,00
HA 7	-0,37	2.666	0,41	-0,30	2.736	0,52	-0,32	2.799	0,49
HA 8	-1,73	2.500	0,00	-1,88	2.550	0,00	-1,98	2.605	0,00
HA 9	-2,11	2.307	0,00	-2,25	2.368	0,00	-2,31	2.394	0,00
HA 10	-0,22	2.863	0,66	-0,17	2.940	0,74	-0,34	2.963	0,51
HA 11	-2,44	2.060	0,00	-2,52	2.113	0,00	-2,63	2.181	0,00
HA 12	-3,13	2.143	0,00	-3,30	2.174	0,00	-3,34	2.227	0,00
HA 13	-1,33	2.336	0,00	-1,44	2.386	0,00	-1,48	2.428	0,00
HA 14	-4,03	2.237	0,00	-4,36	2.318	0,00	-4,41	2.350	0,00
HA 15	-1,15	2.444	0,01	-1,40	2.494	0,00	-1,46	2.511	0,00
HA 16	-3,24	2.541	0,00	-3,49	2.617	0,00	-3,51	2.669	0,00
HA 17	-4,18	2.576	0,00	-4,46	2.621	0,00	-4,49	2.664	0,00
HA 18	-3,86	2.363	0,00	-4,14	2.443	0,00	-4,14	2.473	0,00
HA 19	-4,73	2.476	0,00	-5,20	2.532	0,00	-5,20	2.581	0,00
HA 20	-0,07	2.751	0,88	-0,18	2.840	0,71	-0,28	2.864	0,57
HA 21	-0,71	3.270	0,21	-1,05	3.458	0,08	-1,16	3.445	0,05
HA 22	0,59	2.665	0,22	0,07	2.720	0,88	0,01	2.767	0,98
HA 23	-0,88	3.410	0,15	-1,29	3.645	0,04	-1,38	3.579	0,03
HA 24	4,23	3.144	0,00	4,07	3.206	0,00	3,99	3.261	0,00
year 2000	-0,20	1.766	0,49	-0,42	2.119	0,29	-0,41	2.394	0,31
year 2001	1,34	1.801	0,00	1,32	2.431	0,00	1,34	2.232	0,00
year 2002	-0,84	1.886	0,14	-1,15	2.029	0,06	-1,07	2.302	0,08
year 2003	1,69	1.959	0,00	1,57	2.088	0,00	1,60	2.352	0,00
year 2004	1,69	2.035	0,00	1,56	2.161	0,00	1,59	2.414	0,00
year 2005	1,36	2.240	0,00	1,26	2.384	0,01	1,29	2.598	0,00
year 2006	2,27	2.206	0,00	2,16	2.340	0,00	2,17	2.556	0,00
year 2007	2,13	2.467	0,00	2,02	2.595	0,00	2,05	2.786	0,00

Fixed Effects	Influenza and Pneumonia Model I			Model II			Model III		
	B	**Std. Error**	**Sig.**	**B**	**Std. Error**	**Sig**	**B**	**Std. Error**	**Sig**
HA 1	**0,46**	1.573	0,00	**0,46**	1.612	0,01	**0,46**	1.642	0,01
HA 3	**0,47**	3.144	0,15	**0,50**	3.302	0,14	**0,54**	3.345	0,12
HA 4	**-0,16**	1.495	0,31	**-0,13**	1.538	0,43	**-0,13**	1.565	0,42
HA 5	**-0,48**	2.660	0,08	**-0,50**	2.749	0,07	**-0,46**	2.770	0,10
HA 6	**-0,02**	2.303	0,93	**0,04**	2.403	0,86	**0,01**	2.442	0,97
HA 7	**-0,29**	1.958	0,14	**-0,28**	2.017	0,18	**-0,28**	2.067	0,18
HA 8	**-1,13**	1.836	0,00	**-1,22**	1.880	0,00	**-1,20**	1.924	0,00
HA 9	**-0,58**	1.694	0,00	**-0,62**	1.746	0,00	**-0,62**	1.768	0,00
HA 10	**-1,84**	2.102	0,00	**-1,88**	2.168	0,00	**-1,83**	2.188	0,00
HA 11	**-0,24**	1.512	0,16	**-0,21**	1.558	0,24	**-0,19**	1.611	0,29
HA 12	**0,77**	1.574	0,00	**0,76**	1.603	0,00	**0,78**	1.644	0,00
HA 13	**1,02**	1.715	0,00	**0,97**	1.759	0,00	**0,98**	1.793	0,00
HA 14	**0,84**	1.643	0,00	**0,75**	1.709	0,00	**0,76**	1.735	0,00
HA 15	**1,20**	1.795	0,00	**1,18**	1.839	0,00	**1,16**	1.855	0,00
HA 16	**0,72**	1.866	0,00	**0,73**	1.929	0,00	**0,72**	1.971	0,00
HA 17	**0,22**	1.891	0,25	**0,19**	1.932	0,35	**0,18**	1.967	0,36
HA 18	**-0,56**	1.735	0,00	**-0,63**	1.801	0,00	**-0,65**	1.826	0,00
HA 19	**-0,52**	1.818	0,01	**-0,54**	1.867	0,01	**-0,55**	1.906	0,01
HA 20	**-0,22**	2.020	0,30	**-0,29**	2.094	0,19	**-0,30**	2.115	0,18
HA 21	**-1,15**	2.402	0,00	**-1,21**	2.549	0,00	**-1,26**	2.544	0,00
HA 22	**-0,61**	1.957	0,00	**-0,68**	2.006	0,00	**-0,66**	2.044	0,00
HA 23	**-1,01**	2.504	0,00	**-0,93**	2.687	0,00	**-0,98**	2.643	0,00
HA 24	**-0,71**	2.309	0,01	**-0,75**	2.363	0,01	**-0,73**	2.408	0,01
year 2000	**0,19**	1.297	0,15	**0,09**	1.563	0,60	**0,10**	1.768	0,59
year 2001	**0,13**	1.323	0,35	**0,06**	1.792	0,73	**0,07**	1.648	0,69
year 2002	**0,15**	1.385	0,54	**0,08**	1.496	0,77	**0,15**	1.700	0,57
year 2003	**0,78**	1.438	0,00	**0,71**	1.540	0,00	**0,74**	1.737	0,00
year 2004	**0,61**	1.495	0,00	**0,53**	1.593	0,00	**0,57**	1.783	0,00
year 2005	**1,67**	1.645	0,00	**1,59**	1.758	0,00	**1,63**	1.918	0,00
year 2006	**1,62**	1.620	0,00	**1,54**	1.725	0,00	**1,59**	1.888	0,00
year 2007	**1,94**	1.811	0,00	**1,82**	1.913	0,00	**1,90**	2.057	0,00

Fixed Effects	Dorsopathies Model I			Model II			Model III		
	B	**Std. Error**	**Sig.**	**B**	**Std. Error**	**Sig**	**B**	**Std. Error**	**Sig**
HA 1	**-0,59**	.390	0,00	**-0,60**	.399	0,00	**-0,60**	.406	0,00
HA 3	**-0,35**	.779	0,04	**-0,32**	.817	0,07	**-0,35**	.827	0,05
HA 4	**-0,22**	.370	0,05	**-0,20**	.381	0,10	**-0,20**	.387	0,09
HA 5	**0,22**	.659	0,15	**0,18**	.680	0,26	**0,19**	.685	0,23
HA 6	**0,06**	.570	0,71	**-0,04**	.595	0,85	**-0,04**	.604	0,84
HA 7	**0,21**	.485	0,09	**0,24**	.499	0,07	**0,21**	.511	0,11
HA 8	**-0,24**	.455	0,07	**-0,24**	.465	0,09	**-0,25**	.476	0,07
HA 9	**-0,05**	.420	0,67	**-0,03**	.432	0,84	**-0,06**	.437	0,64
HA 10	**-0,66**	.521	0,00	**-0,71**	.536	0,00	**-0,68**	.541	0,00
HA 11	**-0,63**	.375	0,00	**-0,64**	.386	0,00	**-0,69**	.398	0,00
HA 12	**-0,50**	.390	0,00	**-0,52**	.397	0,00	**-0,53**	.407	0,00
HA 13	**-0,45**	.425	0,00	**-0,48**	.435	0,00	**-0,49**	.444	0,00
HA 14	**0,04**	.407	0,70	**-0,08**	.423	0,49	**-0,09**	.429	0,46
HA 15	**0,34**	.445	0,02	**0,32**	.455	0,04	**0,30**	.459	0,05
HA 16	**-0,22**	.462	0,12	**-0,26**	.477	0,09	**-0,26**	.488	0,08
HA 17	**-0,53**	.469	0,00	**-0,57**	.478	0,00	**-0,58**	.487	0,00
HA 18	**1,60**	.430	0,00	**1,66**	.446	0,00	**1,63**	.452	0,00
HA 19	**1,11**	.450	0,00	**1,13**	.462	0,00	**1,07**	.472	0,00
HA 20	**0,66**	.500	0,00	**0,68**	.518	0,00	**0,64**	.523	0,00
HA 21	**-0,09**	.595	0,68	**-0,04**	.631	0,85	**-0,11**	.629	0,62
HA 22	**-0,75**	.485	0,00	**-0,83**	.496	0,00	**-0,85**	.506	0,00
HA 23	**-0,97**	.620	0,00	**-1,10**	.665	0,00	**-1,09**	.654	0,00
HA 24	**0,10**	.572	0,63	**-0,01**	.585	0,98	**-0,03**	.596	0,89
year 2000	**0,10**	.321	0,24	**0,06**	.387	0,61	**0,06**	.437	0,63
year 2001	**0,30**	.328	0,00	**0,31**	.443	0,01	**0,31**	.408	0,01
year 2002	**0,36**	.343	0,04	**0,33**	.370	0,08	**0,31**	.421	0,10
year 2003	**0,60**	.356	0,00	**0,58**	.381	0,00	**0,58**	.430	0,00
year 2004	**0,71**	.370	0,00	**0,68**	.394	0,00	**0,68**	.441	0,00
year 2005	**0,81**	.407	0,00	**0,79**	.435	0,00	**0,79**	.475	0,00
year 2006	**0,89**	.401	0,00	**0,86**	.427	0,00	**0,86**	.467	0,00
year 2007	**0,84**	.449	0,00	**0,83**	.473	0,00	**0,82**	.509	0,00